EDISON
ELECTRIC INSTITUTE
BULLETIN

PERIODICAL ROOM

MAY, 1937

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MAY 25 1937
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EDISON ELECTRIC INSTITUTE

STATISTICAL DATA OF THE ELECTRIC LIGHT AND POWER INDUSTRY

Compiled Monthly by the Edison Electric Institute—Covers 100% of the Industry

DURING THE MONTH OF FEBRUARY

	1937	1936	%
Kilowatthours Generated* (net)			
By Fuel	5,491,447,000	5,345,065,000	+ 2.7
By Water Power	3,260,989,000	2,643,210,000	+23.4
Total Kilowatthours Generated	8,752,436,000	7,988,275,000	+ 9.6
Additions to Supply			
Energy Purchased from Other Sources	252,120,000	152,926,000	+64.9
Net International Imports	87,651,000	66,398,000	+32.0
Total	339,771,000	219,324,000	+54.9
Deductions from Supply			
Energy Used in Electric Railway Departments	50,784,000	58,765,000	−13.6
Energy Used in Electric and Other Departments	114,663,000	122,948,000	− 6.7
Total	165,447,000	181,713,000	− 9.0
Total Energy for Distribution	**8,926,760,000**	**8,025,886,000**	**+11.2**
Energy Lost in Transmission, Distribution, Etc.	**953,890,000**	**1,026,853,000**	**− 7.1**
Kilowatthours Sold to Ultimate Consumers	**7,972,870,000**	**6,999,033,000**	**+13.9**
Sales to Ultimate Consumers (kwhrs)			
Domestic Service	1,573,449,000	1,340,441,000	+17.4
Commercial—Small Light and Power (Retail)	1,533,718,000	1,323,605,000	+15.9
Commercial—Large Light and Power (Wholesale)	4,114,614,000	3,513,534,000	+17.1
Municipal Street Lighting	184,000,000	218,549,000	−15.8
Railroads—Street and Interurban	400,816,000	435,203,000	− 7.9
Railroads—Electrified Steam	95,468,000	95,545,000	− 0.1
Municipal and Miscellaneous	70,805,000	72,156,000	− 1.9
Total Sales to Ultimate Consumers	7,972,870,000	6,999,033,000	+13.9
Total Revenue from Ultimate Consumers	$183,586,300	$171,219,500	+ 7.2

DURING TWELVE MONTHS ENDING FEBRUARY 28th

Kilowatthours Generated* (net)			
By Fuel	69,639,589,000	57,994,125,000	+20.1
By Water Power	38,118,388,000	36,531,426,000	+ 4.3
Total Kilowatthours Generated	107,757,977,000	94,525,551,000	+14.0
Purchased Energy (net)	3,271,093,000	3,231,484,000	+ 1.2
Energy Used in Electric Railway and Other Departments	2,100,337,000	2,182,491,000	− 3.8
Total Energy for Distribution	**108,928,733,000**	**95,574,544,000**	**+14.0**
Energy Lost in Transmission, Distribution, Etc.	**17,373,692,000**	**16,363,749,000**	**+ 6.2**
Kilowatthours Sold to Ultimate Consumers	**91,555,041,000**	**79,210,795,000**	**+15.6**
Total Revenue from Ultimate Consumers	**$2,086,080,300**	**$1,929,778,000**	**+ 8.1**
Important Factors			
Percent of Energy Generated by Waterpower	35.4%	38.6%	
Domestic Service (Residential Use)			
Average Annual Consumption per Customer (kwhr)	738	683	+ 8.1
Average Revenue per kwhr (cents)	4.66¢	4.96¢	− 6.0
Average Monthly Bill per Domestic Customer	$2.87	$2.82	+ 1.8

BASIC INFORMATION AS OF FEBRUARY 28th

Generating Capacity (kw)—Steam	24,082,553	24,013,000	
—Waterpower	9,550,722	9,300,000	
—Internal Combustion	616,196	611,000	
Total Generating Capacity in Kilowatts	34,249,471	33,924,000	
Number of Customers			
Farms in Eastern Area (Included with Domestic)	(792,617)	(581,452)	
Farms in Western Area (Included with Commercial—Large)	(281,481)	(217,316)	
Domestic Service	21,789,419	21,104,166	
Commercial—Small Light and Power	3,817,987	3,751,002	
Commercial—Large Light and Power	548,054	493,901	
Other Ultimate Consumers	70,820	69,160	
Total Ultimate Consumers	26,226,280	25,418,229	

* By courtesy of the Federal Power Commission, with deductions for certain plants not considered electric light and power enterprises.

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EDISON ELECTRIC INSTITUTE BULLETIN

Volume 5 MAY, 1937 No. 5

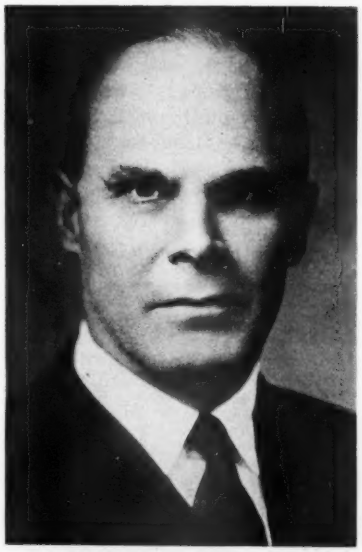
Chicago's Skyline at Night

Chicago Is Ready For E.E.I. Convention

AS in 1933, but without the competition of the "Century of Progress" exposition, the Institute, the first week in June, turns this year to Chicago for its annual meeting and convention. With the historic Palmer House as its headquarters, and all the facilities and attractions of America's great midland metropolis at hand, members of the Institute and representatives of the entire electrical industry from practically every state in the Union are expected in force at this, the fifth convention of the Institute.

Unusual interest in this year's meeting, due in part to general business conditions and governmental activity, and in part to the conditions peculiar to the electrical industry itself, have been expressed in many quarters. A sincere and hearty welcome to delegates and friends is assured by every member of the Chicago Reception Committee, appointed by President C. W. Kellogg, which will be under the chairmanship of Edward J. Doyle, president, Commonwealth Edison Company, assisted by John F. Gilchrist, vice-president of the same company.

A compact program which will begin at 2:30 o'clock on Tuesday afternoon, June 1, and close at noon on the following Friday, will cover many important aspects of present-day utility problems, and the speakers who have been chosen are outstanding in their respective fields.



CHARLES W. KELLOGG

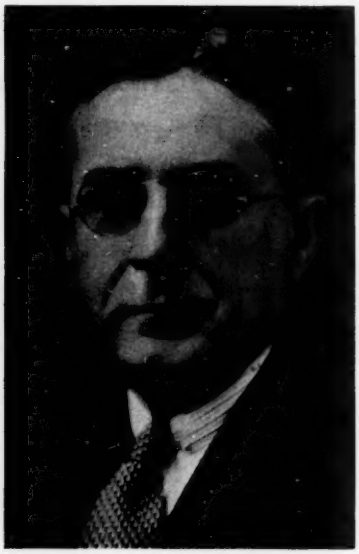
Generalissimo of the Convention — President's Reception Tuesday evening — President's Address Thursday morning—Presides at Banquet Thursday Evening

Each of them has an important contribution to make to the industry in presenting the latest information, practices and results of his own studies and experience.

Among the subjects which will be presented are: Progress towards all-electric homes, what housewives expect of electric service, appliance servicing costs, the opportunities and problems of air conditioning, better light from the medical point of view, the manufacturer's stake in the utility business, recent engineering contributions to society, new products from electrical research, lawmaking by commissions as it affects the industry, accident prevention, liberalism and the electric industry, rural electrification, building and operating utility systems on an interconnected and coordinated basis, what the industry has to offer a young man today, and a study of the public utility industry with special reference to governmental control.

All but three of the speakers on the program are from the electrical field, but these three have topics of particular appeal to the industry at this time. Dr. Morris Fishbein, editor of the *Journal of the American Medical Association*, and author of many books and articles, whose address, "The Doctor Looks at Light" ties in with the Better Light-Better Sight program, is the leading spokesman for the medical profession in this country.

Dr. Gus W. Dyer, Professor of Economics and Sociology at Vanderbilt University, has long been an ardent champion of industry in its struggles against political domination. His address on "Constitutional Regulations versus Governmental Dictations" will not be delivered, it is safe to say, to empty seats. In fact, the flood of early reservations



EDWARD J. DOYLE

President, Commonwealth Edison Company —Chairman, Chicago Reception Committee, the Convention's official welcoming group— Opening speaker at First Session

MISS NANCY FINCH

Home Service Director, Utah Power and Light Company—Will tell what housewives expect of electric service—Hereby nominated as Miss Utah—in any contest

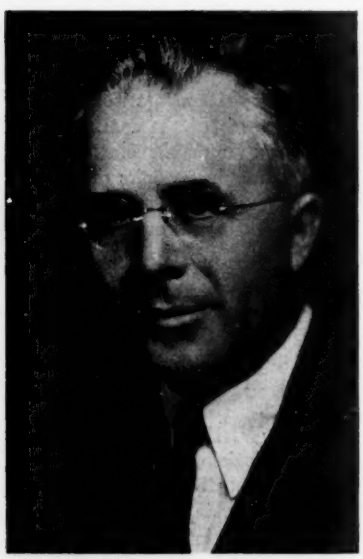
DR. MORRIS FISHBEIN

Editor, Journal of American Medical Association—Medical profession's most articulate hard-hitting member—Looks at Light at First Session

for the banquet at which Dr. Dyer will speak indicates that a larger banquet room than was at first planned will be required.

Likewise, Dean John T. Madden's study of the public utility industry will be an address of the greatest importance. With Dr. Herbert B. Dorau, Dean Madden has been at work for the past two years on six volumes dealing with public utilities, which are of the utmost significance in view of the governmental attacks to which the industry has been subjected.

Among the speakers from the utility field will be President Kellogg, Messrs. E. J. Doyle, Commonwealth Edison Company; Walter A. Forbush, Edison Electric Illuminating Company of Brockton, Brockton, Mass.; Earl W. Gray, Oklahoma Gas & Electric Company, Oklahoma City, Okla.; E. T. Gushee, Detroit Edison Company; H. P. Liversidge, Philadelphia Electric Company; William E. Mitchell, Georgia Power Company, Atlanta; W. C. Mullendore, Southern California Edison Company, Ltd., Los Angeles; D. E. Karn, Consumers Power Company, Jackson, Mich.; Philip Sporn, American



WALTER A. FORBUSH

Vice-President, Edison Electric Illuminating Company of Brockton, Mass.—Tells at opening session how old New England is becoming new again with electricity

JOHN F. GILCHRIST

Vice-President, Commonwealth Edison Company — vice-chairman, Chicago Reception Committee—Heavy duty man on pre-convention and convention details

EARL W. GRAY

Speaks at first session, Tuesday—Will discuss opportunities and problems of air conditioning as he sees them with Oklahoma Gas and Electric Company, Oklahoma City

PHILIP SPORN

American Gas and Electric Company, Vice-President—Wednesday morning speaker—The Building and Operating of Utility Systems on an Interconnected and Coordinated Basis

JAMES E. DAVIDSON

Jim to more people throughout the country, than even the Jim in the other camp—but doesn't write so many letters—presides at Wednesday morning session

H. P. LIVERSIDGE

Vice-President, Philadelphia Electric Company—Able young men wanted—electric utility field has something to offer them—Second Session

Gas & Electric Company, New York; J. F. Porter, Jr., Kansas City Power & Light Company, Kansas City, Mo.; R. E. Fisher, Pacific Gas and Electric Company, San Francisco; Frank W. Smith, Consolidated Edison Company of New York; Bernard F. Weadock, Edison Electric Institute; and Miss Nancy Finch, Utah Power and Light Company, Salt Lake City, Utah.

From the electrical manufacturing field will come C. E. Wilson, vice-president in charge of sales, General Electric Company, Bridgeport, Conn.; N. G. Symonds, vice-president, Westinghouse Electric & Manufacturing Company, Pittsburgh, Pennsylvania; and Dr. L. W. Chubb, director of the Westinghouse Research Laboratories at East Pittsburgh.

The Chicago Reception Committee includes, besides Messrs. Doyle and Gilchrist as chairman and vice-chairman, Messrs. Charles W. Bradley, vice-president, Public Service Company of Northern Illinois; William Chamberlain, chairman, United Light and Power Company; A. G. deClercq, vice-president, Commonwealth Edison Company; B. J. Denman, vice-president, United

N. G. SYMONDS

Vice-President, Westinghouse Electric and Manufacturing—the manufacturer's stake in the utility business—from the manufacturer's standpoint. Second Session

EDWARD T. GUSHEE

Vice-President, The Detroit Edison Company. Will discuss Mr. Symond's talk—from the other side of the fence, but not necessarily in opposition—Second Session

C. E. WILSON

Vice-President, General Electric Company—Second Session—Talks on "The Electrical Standard of Living"—a phrase with which the country is rapidly becoming familiar

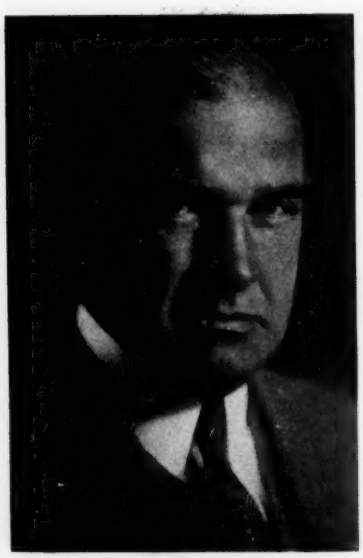
J. F. PORTER, JR.
Vice-President, Kansas City Power and Light —picked "Selling" as his topic—what delegate can afford to miss a talk on this subject? —Third Session

J. G. HOLTZCLAW
President, V. E. P. Co.—Experienced presiding officer who will guide the program through the Third Session—promises it will start—and end—on the dot

R. E. FISHER
Vice-President, Pacific Gas and Electric Company—Third Session—will speak on subject of vital interest to many companies— "Appliance Servicing Costs"

Light and Power Company; Harry B. Gear, vice-president, Commonwealth Edison Company; Robert J. Graf, president, H. M. Byllesby and Company; Julius L. Hecht, vice-president, Public Service Company of Northern Illinois; Colonel R. H. Jones, president, Super-Power Company of Illinois, and president, Chicago District Electric Generating Corporation; George R. Jones, president, Western United Gas and Electric Company, and vice-president, Public Service Company of Northern Illinois; E. W. Lloyd, vice-president, Commonwealth Edison Company; B. W. Lynch, president, Public Utility Engineering and Service Corporation; C. S. McCain, president, United Light and Power Company, and Purcell L. Smith, vice-president, Commonwealth Edison Company.

The Arrangements Committee, upon which the heaviest part of the pre-convention duties have rested, includes Edward P. Johnson, Commonwealth Edison Company, Chicago, as chairman; H. T. Anderson, W. H. Childs, John W. Evers, Jr., Louis A. Ferguson, Jr., Gardner S. Howland, P. B. Juhnke,



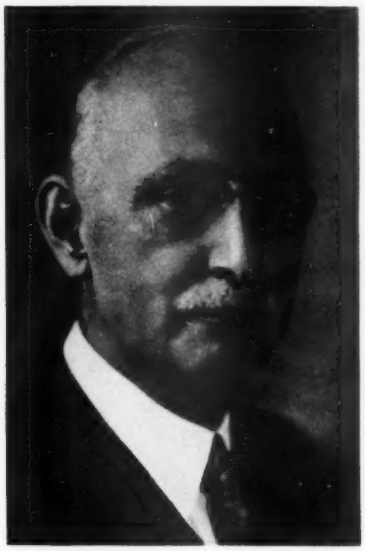
BERNARD F. WEADOCK
That Fourth—That New Branch of Government—will be the subject of the Institute's Vice-President and Managing Director— Third Session

D. E. KARN
Rural Electrification—has pitfalls peculiarly its own, as those with long experience know E.E.I.'s R. E. Committee Chairman will tell where it stands today—Fourth Session

DR. L. W. CHUBB
What good from research laboratories? The Director of Westinghouse Research Laboratories will show with demonstration of new products—Third Session

DR. GUS W. DYER

Professor of Economics, Vanderbilt University—can disclose the fallacies of tampering with the laws of economics in a manner most embarrassing to some professors — Banquet



FRANK W. SMITH

Now a Grand Old Man of the Industry—says he's retiring—everybody that believes it stand on your head—Hands out prizes—Final Session

DEAN JOHN T. MADDEN

Dean of the School of Commerce, New York University—contends the public must be protected—and that it also must know the truth —Final Session

E. J. Lavin, C. A. Lind, Miss Helen Norris, R. R. Pilkington, J. F. Rice, W. R. White and Harold Wright.

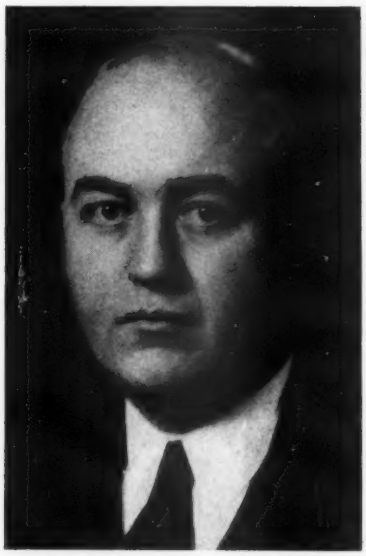
Besides the general sessions, several important committee meetings will take place. The Operating Committee will have a luncheon meeting at one o'clock on Wednesday, June 2. The Board of Trustees will meet either Wednesday evening or Thursday morning. The Sales Committee and the Statistical Committee will also meet during the week.

As many of the delegates will be accompanied by their families, a special program of entertainment for the ladies has been prepared. This will include luncheon and bridge in the Marine Dining Room of the Edgewater Beach Hotel on Wednesday, June 2, and a fashion show and tea at Marshall Field & Company on June 3. Chartered buses will be provided for transportation to and from the Edgewater Beach Hotel. A cordial invitation is extended to all ladies attending the Convention to attend both of these events. Detailed information may be obtained at the Registration Desk at the time of the Convention.

All business sessions of the Convention

W. E. MITCHELL

Vice-President and General Manager—Georgia Power Company—Fourth Session—speaks on the prevention of accidents—continuously important subject in every utility



A. H. KEHOE

Vice-President, Consolidated Edison Company of New York. An engineer at the top who can still run a slip stick—presides at Fourth Session

W. C. MULLENDORE

Southern California Edison Company, Ltd., sends its Executive Vice-President to tell what Liberalism in the Electric Industry means—Final Session

itself will take place in the Grand Ballroom of the Palmer House. The President's Reception on Tuesday evening will be in the Red Lacquer Room; there will also be dancing on Wednesday and Thursday evenings.

Members of the Institute staff and others officially connected with the Convention will be at the service of the delegates in every way possible. Everything which will add to the convenience and pleasure of delegates and their families will be done, with the added certainty that hotel men and others will make every effort that can be made to make the Convention enjoyable and memorable.

The five general sessions of the Convention will be open to all who wish to attend, whether members of the Institute or not, the only requirement for admission being registration. The programs for the five day-time sessions are here summarized:

THE PROGRAM

First Session, Tuesday Afternoon, June 1, from 2.30 to 5 P.M.

E. J. Doyle, president, Commonwealth Edison Company, upon whose shoulders as chairman of the Chicago Reception Committee so much of the actual preparatory work of the Convention has rested, will extend official welcome to the Institute at the opening of the first session. Following Mr. Doyle will be Walter A. Forbush, Edison Electric Illuminating Company of Brockton, Mass., who will speak on "Progress Toward Electric Homes in Conservative New England," where recent reports have it that in some sections there 60 per cent of all new homes being constructed are all-electric.

Dr. Morris Fishbein's address, "The Doctor Looks at Light," will follow, and will present the medical profession's point of view as to the importance to human welfare of the campaigns for better seeing which the industry is promoting. Dr. Fishbein will be followed by the only woman on the Convention program, Miss Nancy Finch, of the Utah Power & Light Company, Salt Lake City. Miss Finch, who organized and now directs the Home Service Department of her company, will tell "What Housewives Expect of Electric Service in the West."

Earl W. Gray, the final speaker at this session, takes as his subject "Conditioned Air—Its Opportunities and Problems," a subject of rapidly increasing importance in all parts of the country.

R. C. MUIR

Vice-President, General Electric Company—Final Session—points out some present contributions to society which have originated in the work of the electrical engineer

Oklahoma Gas & Electric Company, of Oklahoma City, which Mr. Gray represents, has had some instructive experience in this field, and Mr. Gray's address is anticipated with interest.

Second Session, Wednesday Morning, June 2, 9.30 A.M. to 12.00 M.

"The Building and Operating of Utility Systems on in Interconnected and Coordinated Basis," is the opening topic for the Wednesday morning session. The speaker will be Philip Sporn, vice-president and chief engineer, American Gas & Electric Company, New York, who has material of unusual importance and interest to present. C. E. Wilson, vice-president in charge of sales, General Electric Company, Bridgeport, Conn., will be the second speaker. The opportunities for youth in the electric utility industry will be discussed by H. P. Liversidge, Philadelphia Electric Company, Philadelphia, Pa., who believes that since the electrical industry is still young itself it can offer able and ambitious young men a great deal.

"The Manufacturer's Stake in the Utility Business" is the title of the next address, which will be delivered by N. G. Symonds, vice-president of Westinghouse Electric and Manufacturing Company, East Pittsburgh. The subject is of special importance at this time because of the support which many manufacturers are giving to promotional programs conducted jointly with the utility companies through the Institute. The concluding speaker at this session will be E. T. Gushee, vice-president, The Detroit Edison Company.

Third Session, Wednesday Afternoon, June 2, from 2.30 to 5 P.M.

The third session will open with the report of the Nominating Committee and the election of Trustees. Immediately following this there will be an address by J. F. Porter, Jr., vice-president in charge of sales, Kansas City Power & Light Company, Kansas City, Mo. Mr. Porter "grew up" with his present company, of which his father is president. He will have "Selling" as his subject. Mr. Porter will be followed by Bernard F. Weadock, vice-president and managing director of the Institute, who will speak on "The Fourth Branch of the Government," a subject of vital moment to everyone in the utility field, since law-making by commissions seems to be the order of the day.

R. E. Fisher, vice-president of Pacific Gas & Electric Company in charge of public relations and sales, will be the next speaker, his topic being "Appliance Servicing Costs." Mr. Fisher has been associated with his company for 26 years. He has served as chairman of the Pacific Coast Electrical Bureau and president of the Pacific Coast Gas Association, the Pacific Coast Electrical Association and the San Francisco Electrical Development League.

The closing feature of this session will be a demonstration of new products from research in the electrical industry, by Dr. L. W. Chubb, Director of the Research Laboratory, Westinghouse Electric and Manufacturing Company East Pittsburgh, Pa. It is expected that a number of products not previously announced will be shown and explained at this time.

Fourth Session, Thursday Morning, June 3, from 9.30 A.M. to 12 M.

The prevention of accidents will be the subject of the opening address at the fourth session, with William E. Mitchell as the speaker. Mr. Mitchell, vice-president and general manager of the Georgia Power Company, Atlanta, has been particularly interested in accident prevention activities, and his message will be worthy of close attention. He will be followed by President Kellogg of the Institute, who has not as yet disclosed the subject which he will discuss, but it is expected that he will touch upon the activities of the Institute during the past year and include his usual exacting references to certain of

(*Continued on page* 200)

GENERAL INFORMATION ON THE FIFTH ANNUAL CONVENTION

ALL of the convention business sessions will be held in the Grand Ballroom of the Palmer House. The first session will be held on Tuesday, June 1, at 2:30 p. m. There will also be sessions on Wednesday morning, June 2, at 9:30 a. m.; Wednesday afternoon at 2:30 p. m.; Thursday morning, June 3, at 9:30 a. m. and Friday morning, June 4, at 9:30 a. m., with adjournment at noon on that day.

Registration will open at 10:30 a. m. on Tuesday in the corridor adjacent to the Grand Ballroom. There will be no charge for registration, but registration is necessary to obtain the convention badge, programs, etc. The registration booth will be open on Tuesday, Wednesday, Thursday and Friday during the sessions.

Recreation

On Tuesday evening, at 9:30 p. m. the President's Reception will be held in the Red Lacquer Room, which will be followed by dancing. A luncheon and card party will be held at the Edgewater Beach Hotel on Wednesday, June 2, for the ladies attending the convention. Buses will leave the Palmer House at 1:45 p. m. returning about 6 p. m. There will be tables for cards following the luncheon and prizes will be provided for each table. On Wednesday evening at 9 p. m. there will be dancing and entertainment in the Grand Ballroom. A fashion show and tea has been arranged for the ladies at 3:30 p. m. on Thursday, June 3, at Marshall Field and Company. This event will be held in the Walnut Room on the seventh floor. Admittance to both the luncheon and card party and the fashion show will be by the convention badge, which all delegates are requested to wear.

There being no business session on Thursday afternoon delegates may wish to take sight-seeing tours, visit certain generating plants of the Commonwealth Edison Company, play golf or otherwise occupy themselves during this half day. Information may be secured from the Entertainment Committee desk adjacent to the Registration Counter.

The banquet will be held on Thursday evening, June 3, at 7:30 p. m., in the Grand Ballroom. Reservations for tables should be sent to Mr. John F. Gilchrist, vice-president, Commonwealth Edison Company, Chicago, Ill., and checks for such reservations should be made payable to Mr. George W. Williamson, treasurer of this company. Announcement-invitations and reservations cards may be secured from the Secretary of the Institute at 420 Lexington Avenue, New York.

Hotels and Transportation

A circular, giving rates and locations of the principal Chicago Hotels together with reservation blank has been sent to all members of the Institute. Reservations should be sent direct to the hotel of the first choice.

With the general reduction in railroad rates during the past year, special rates for conventions have been discontinued. In consequence certificates or special instructions regarding railroad rates will not be necessary in connection with the June convention. It is suggested that local ticket agents be consulted as to the lowest possible rates. Railroad and air schedules from the East are contained in the Hotel and Transportation Circular.

SCHEDULE

Tuesday, June 1
- Registration will open at 10:30 a. m.
- First Business Session, 2:30 p. m.
- President's Reception, 9:30 p. m., followed by dancing.

Wednesday, June 2
- Registration will open at 8:45 a. m.
- Second Business Session, 9:30 a. m.
- Buses will leave at 12:45 p. m. to take the ladies to luncheon and bridge at the Edgewater Beach Hotel.
- Third Business Session, 2:30 p. m.
- Dancing, 9:00 p. m. in the Grand Ballroom.

Thursday, June 3
- Registration will open at 8:45 a. m.
- Fourth Business Session, 9:30 a. m.
- No business session has been scheduled for this afternoon. A Fashion Show and Tea for the ladies at 3:30 p. m. at Marshall Field and Company.
- Banquet, 7:30 p. m. in the Grand Ballroom.
- Dancing, 10:30 p. m. in the Red Lacquer Room.

Friday, June 4
- Registration will open at 9 a. m.
- Fifth Business Session, 9:30 a. m.
- Adjournment, 1 p. m.

RATES QUOTED BY CHICAGO HOTELS FOR THE 1937 EDISON ELECTRIC INSTITUTE CONVENTION

Hotels and Locations	Rates by the Day: Single with Bath	Double with Bath	Twin Beds with Bath
ATLANTIC 316 South Clark Street	$2.00 up	$3.00 up	$4.00 up
BISMARCK 175 West Randolph Street	3.50 up	5.00 up	6.00 up
BLACKSTONE South Michigan at Seventh	3.50 up	5.00 up	6.00 up
CONGRESS Michigan at Congress	3.00 up	5.00 up	5.00 up
DRAKE Lake Shore Drive & Michigan Avenue	3.50 up	5.00 up	6.00 up
EDGEWATER BEACH 5349 Sheridan Road	5.00 up	7.00 up	7.00 up
GREAT NORTHERN 237 South Dearborn Street	2.50 up	3.50 up	5.00 up
HARRISON Harrison & Wabash	2.00 up	3.00 up	4.00 up
KNICKERBOCKER 163 East Walton Place	3.00 up	5.00 up	6.00 up
LaSALLE LaSalle and Madison	3.00 up	4.00 up	6.00 up
MORRISON Madison and Clark Streets	2.50 up	4.00 up	5.00 up
PALMER HOUSE 15 East Monroe Street	3.00 up	5.00 up	6.00 up
SHERMAN 106 West Randolph Street	2.50 up	4.00 up	5.00 up
SHORELAND 5454 South Shore Drive	5.00 up	6.00 up	7.00 up
STEVENS Seventh & Michigan Drive	2.50 up	4.00 up	5.00 up

Before and After Convention Sessions

A Few Suggestions on Things to Do and See in Chicago

DELEGATES to the annual convention of the Edison Electric Institute, to be held in Chicago June 1-4, will find the country's second largest city teeming with things to do and places to go between business sessions.

Two shows of special interest to men and women in the electric light and power industry will be presented at the Chicago Lighting Institute, 20 North Wacker Drive Building, during the convention.

"At Home with the Range," a sketch dramatizing the advantages of electric range cooking, will be presented on Wednesday, June 2, at 8 p.m. This will be a special performance in the series which is given for employees of the Commonwealth Edison Company and their families as a feature of Chicago's cooperative electric range campaign.

"House of Light Magic," a show depicting the latest and most spectacular developments in the art of illumination, will be presented by the Chicago Lighting Institute staff the evenings of June 1, 3 and 4 at 8 o'clock. Demonstrations of new applications of the electric eye, "poplarized light," theatrical lighting effects and gaseous tube lighting are included in this pageant of illumination.

Free tickets to "At Home with the Range" and "House of Light Magic" will be available for delegates at the Registration Desks in the Palmer House.

Commonwealth Edison Company is constructing a six-room all-electric demonstration home near the heart of Chicago's greatest neighborhood shopping center in Englewood. This Golden Anniversary Electric Home, as it will be known, is being rushed to completion in order to have it ready for public inspection by the time of the E.E.I. Convention.

Of Cape Cod cottage style of architecture, the house will be built around its electrical conveniences. It will contain the latest household electrical appliances, lighting and wiring, and provide a preview of the household electrical applications of tomorrow.

The all-electric kitchen will be equipped with an electric range, refrigerator, dishwasher and numerous small appliances. Localized light will be provided by a recessed fixture over the sink and dishwasher, and by concealed "lumiline" tubes along cabinets.

The house will be completely air-conditioned and attic ventilation by means of an exhaust fan will also be demonstrated. "Plug-in-Strip" which affords an electric outlet every six inches along the wall, will be used in the kitchen, living room, recreation room and in the electrified workshop for the man of the house.

I.E.S. portable lamps will be extensively used and decorative illumination will include cove lighting, picture and drapery lighting, and illuminated book-shelves and china cabinets.

Chicago's attractions for visitors include many world-famed institutions.

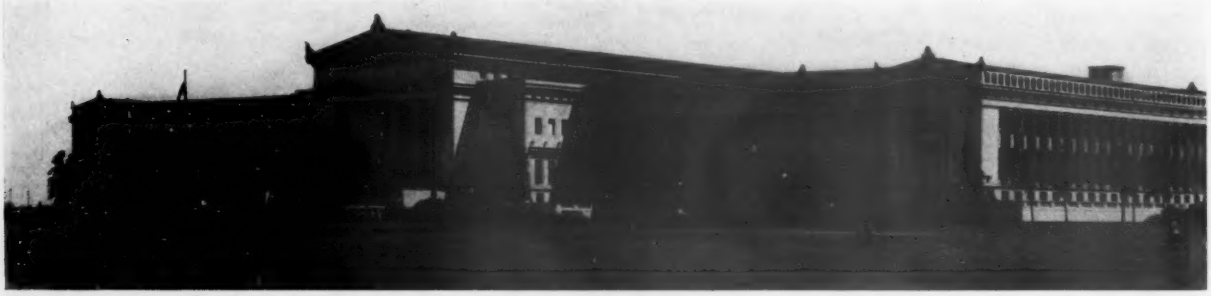
At the Adler Planetarium, located on the shore of Lake Michigan just a few minutes from the Loop, the path of the stars, the moon and entire celestial orbit is reproduced on an artificial sky.

Nearby is the field Museum of Natural History, in which hundreds of interesting exhibits depict the universe—from creation to today—in anthropology, botany, geology and zoology. And a few steps away, the Shedd Aquarium, newest and most complete institution of its kind, displays the rarest specimens of the piscatorial world.

The Museum of Science and Industry, housed in the reconstructed Fine Arts Building of the Chicago World's Fair of 1893, graphically portrays the most important discoveries and advances of science and demonstrates their application to modern commerce and industry. A coal mine in actual operation is one of its principal exhibits.

Brookfield Zoo, located a short distance outside Chicago, is one of the world's most unusual zoological parks. Instead of cages and bars, moats confine the animals, and realistic forests and gullies further simulate their native habitat.

One of the finest historical collections in the country is contained in the Chicago Historical Museum in Lincoln Park. The death-bed of Abraham Lincoln, the anchor dropped by Christopher Columbus when he first landed in America, and relics of French and Spanish explorers are included among its exhibit.



Field Museum

At the Oriental Institute of the University of Chicago, civilizations of Babylon, Thebes and other ancient cities are revealed in the exhibits brought back from the explorations of the late Professor Breasted and other noted scientists. Most striking of the displays is a model of the Tower of Babel.

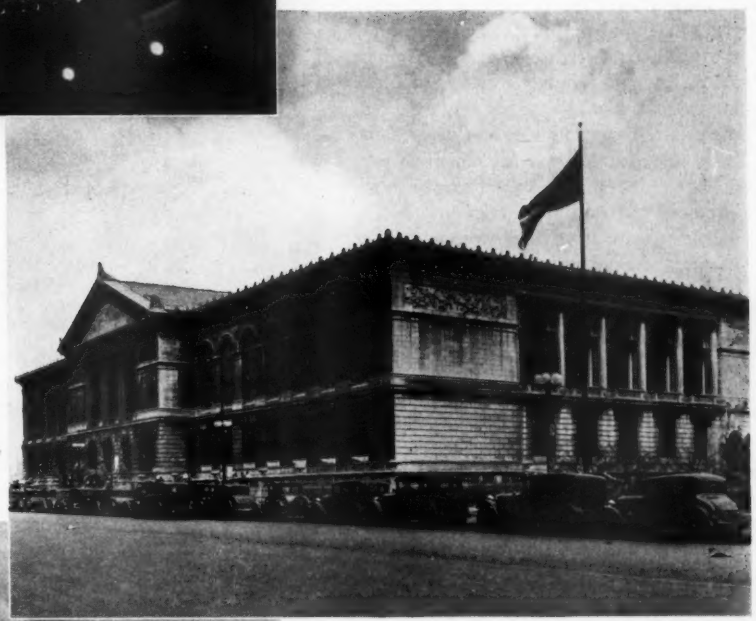
State Street, known as the world's most brilliantly lighted shopping thoroughfare, also ranks as a Chicago institution. Famed for its large centrally-located department stores and novel shops, State Street will pique the interest of every convention delegate.

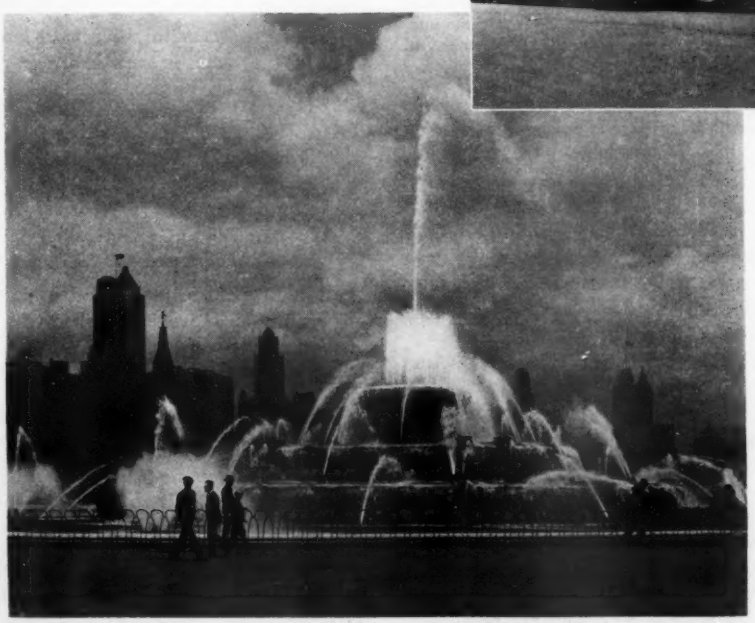
Chicago affords its visitors an opportunity to see at first hand the "melting pot" of America. Chinatown, the Maxwell Street Ghetto, Little Italy, and the Greek, Russian and Japanese sectors of the city provide an interesting cross-section of Old World customs and traditions.

Above—Soldiers Field Under Floodlights

Right—Chicago Art Institute

Below—Buckingham Fountain





Baseball fans will be able to see two American League rivals in action against the Chicago White Sox during the convention. The St. Louis Browns will play in Chicago on June 1 and the Boston Red Sox will meet the White Sox on June 2, 3 and 4. Horse racing will be a daily feature at Washington Park track, located at Homewood, Illinois, about 40 minutes by train from the Chicago Loop.

Electric Water Heating Arrives

By K. M. Robinson

President, Idaho Power Company, Boise, Idaho

An address before the Fourth National Sales Conference, Edison Electric Institute, Chicago, March 30-31

AS chairman of the Electric Water Heating Committee for this year I appreciate the opportunity of again saying a few words regarding the possibilities of electric water heating as a major load building item for our industry during the year 1937.

All of us realize the necessity for new revenue if we are to pay the increased taxes that are being thrust upon us; meet the necessary increase in wages brought about by higher living costs; absorb the increased cost of other operating expenses, materials, etc., and leave at least some little increase in net with which to pass on rate reductions that are being so much discussed at this time, particularly by the politicians. I am sure we cannot expect to meet these increased costs from our present revenues, nor from the normal increase in revenues which we may anticipate from ordinary load building programs.

Electric water heating is certainly one of the major load building items that can be pushed to the forefront in 1937. It is one item that we can sell because of its large revenue with practically no capital investment. It is a service which presents practically no service problem. It produces a use of from 3000 to 4000 kwhr per year, making it the greatest kilowatt-hour user of any load building item in the home. The fact that more water heaters were sold in 1936 than in the four previous years indicates that it is receiving public acceptance.

There are four big forces that open the door to greater electric water heating revenue in 1937:

(1) National income is rising. The $60,000,000,000 national income of 1936 is 50 per cent greater than the national income of 1932. The $7,000,000,000 increase of 1936 over the previous year is proving to be a great stimulator of trade.

(2) Home improvements head the list of recovery expenditures. The Curtis Publishing Company tells us that 37 per cent of the soldiers' bonus dollars was spent for home furnishings. Electric refrigerator sales in 1936 were 275 per cent of the 1929 sales.

(3) 450,000 new homes will be built this year as compared with 200,000 in 1936. This increase in home construction presents wonderful opportunities for increased electric water heater sales.

MR. ROBINSON

(4) Electric water heating is claiming the attention of editors. Editors of leading women's magazines started the campaign which resulted in the banishment of the old-fashioned parlor, legislation for clean milk and pure food laws, and sanitary distribution of food products. Editors of these same publications are now promoting the benefits of hot water in the home. The many articles which will appear in both the ladies' magazines and trade publications during the year 1937 will go a long way toward making our job of selling adequate hot water heating service easier.

With all of these helps, it would seem that now is the time for our industry to start a major drive to install 24-hour thermostatically controlled hot water heating service in the homes of our customers.

The National Electric Water Heating Council sponsored by the National Electric Manufacturers Association and the Edison Electric Institute have prepared a water heating plan for the year 1937 which should be in the hands of the operating utilities within the next two weeks. The Plan Book and the follow-up material during the balance of 1937, while not perfect, will go a long way toward helping utilities who have not previously sold electric water heating as a major item to set up their plans for the year. The Council will continue contacts with editors of magazines and newspapers to acquaint them with the benefits of electric water heating, furnishing them with articles and information and cooperate with the development of information which will lead to stories for newspapers and magazines. The Council will also furnish newspaper articles about hot water and electric water heating which you can use in your local newspapers, will furnish material for commercial radio announcements, and as a major incentive will sponsor the National Electric Water Heating Council award consisting of a silver trophy and a prize of $1,000 to the winning company in 1937. To enter this contest it will be necessary to conduct a two months' electric water heating campaign sometime during the year 1937. The basis of this award will be somewhat different than other national contests in that it will be based upon the plan for the two months' campaign, the execution of this plan in addition to the unit sales per 1000 customers, and increase in sales over the previous year. Complete details will be furnished later in connection with this contest.

Our own company has had more than 20 years' experience in the sale of electric hot water heating service. Much of this experience has been anything but pleasant. In the early days we had flat rates as low as $1.70 per month for installations of 1 kw. Later these rates were declared confiscatory after several years of hearings before the Public Utilities Commission and the Federal court. In 1924 a 5 mill rate for old customers and 10 mills for new customers was established which existed until 1927 when a 1½c per kilowatt hour rate was established. During the first metered rate period our customers dropped to less than half of those served in the flat rate days. We gradually brought back our customers by insulating tanks and installing thermostats, but these built-up installations were not satisfactory for any long period of time. Beginning in May, 1935, we have sold only factory built, twin unit, thermostatically controlled installations, and from May 1, 1935, to the end of 1936 we have about

(*Continued on page* 196)

Black and White Coal

By C. W. Kellogg
President, Edison Electric Institute

A talk before the Annual Convention of the West Virginia Chamber of Commerce, White Sulphur Springs, West Virginia, at a dinner meeting, April 16, 1937.

IT is common knowledge that for many decades of our industrial growth as a nation the availability of an adequate supply of coal was the essential handmaiden of progress so far as mechanical power was concerned. It is equally well known that in the last twenty years the prosperity of the coal mining industry has been adversely affected by a series of shocks—by the introduction to the market of gas and oil as competing fuels, the continual improvement in the economy of coal burning and, finally, the development of water power, which some have called "white coal."

I have no intention to discuss at this time the subject of oil and gas but I should like to present some comparative figures regarding present day fuel economy and water power, for the two are definitely related; and furthermore, as menaces to the coal mining business, the first bids fair in the future to tend to offset the second.

Going back thirty years to 1907, when the Keokuk Dam on the Mississippi River was being actively projected, the average amount of coal required to produce a kilowatt hour of electricity in that year was 5.4 lb. Even ten years later the amount required was 3.3 lb. Today the country-wide average is about 1.45 lb, and for a modern steam power station of 100,000 kw capacity, using your good West Virginia coal every pound of which contains at least 14,000 heat units, a ratio of 0.89 of a pound per kilowatt hour can be shown.

For the benefit of those technically familiar with electric power plant construction and operation, let me say that I am not, in my present day plant, figuring on an exceptional station, but on one using 850 lb steam pressure and 900 deg. temperature, representing standard modern practice.

If, therefore, as producers, you may stand appalled at the fact that the coal required to produce a kilowatt hour has been cut nearly in quarters in the last thirty years, on the other hand it must be clear that an economic advantage of water power over steam power which might have been obvious in 1907, or even 1917, stands a strong chance of being just the reverse today.

If this were all there was to this matter, my talk would be quickly over. In fact, for many of you, what I have said is already "old stuff"; but there are other questions which leap to the mind from the figures I have given which are of interest to you not only as coal producers but as citizens of the nation.

Surely it is a matter of the highest importance to you to inquire whether, in the light of these figures, the Government is well-advised to proceed as vigorously as it is doing with the production of hydroelectric power on the Tennessee River, if, as I believe I can show, electricity can be produced more cheaply by burning coal and producing steam.

At the present time unemployment is still our greatest national problem. The labor required to operate a water power plant, once it is constructed, is very small, while with a steam plant not only is more labor required to operate the same sized plant, but an even greater amount of labor is required to mine the coal which would be burned therein to produce electric energy. From the viewpoint of solving the unemployment problem, therefore, the preference should be greatly in favor of steam power production compared to hydro. To make this statement more specific, a report of the National Industrial Conference Board indicates that for seven years past 93 per cent of the cost of coal mining is payroll—a figure so large that we may say employment is of the essence of coal mining.

The other aspect of the matter is that of relative cost. With regard to that the facts based on official records are as follows:

Our first problem is to establish the cost of hydroelectric power from the TVA system. The estimated cost per kilowatt of firm power averaged for the eight combination navigation and power dams built, building or to be built on the Tennessee River is $537. The computation of this figure is shown on the table at the top of the following page, but I desire, for the record, to state the sources from which the data are derived upon which the table was constructed.

1. The estimated cost of the eight dams ($360,000,000) is from page 279 of testimony before the House Appropriations Committee in connection with the First Deficiency Appropriation Bill 1936.

2. The continuous power corresponding to the regulated stream flow is from Table IV of a Special Report to Congress by TVA dated March 30, 1936.

3. The allocation of 75 per cent of the cost of dams to electric power is computed as follows:

Estimated Cost of Dams (exclusive of Wilson Dam, which was already built when House Document No. 328 was prepared)	$306,000,000
Estimated cost of Complete Canalization of Tennessee River with low dams (Report of U. S. Army Engineers, House Document No. 328, 71st Congress, 2nd Session)	74,709,000
Difference (necessarily representing electric power alone)	$231,291,000
Per cent of total chargeable to electric power alone	75.4

From the same page 279, of testimony before the Appropriations Committee, costs of power operation are stated at 9 per cent on the investment, of which 7½ per cent is fixed charges. This 7½ per cent makes, on the $537 investment per kilowatt of firm power, an annual fixed charge of $40.30 per kilowatt, and, finally, at an annual load factor of 50 per cent (which is much higher than the national average) the cost per kilowatt hour for fixed charges alone would be 9.2 mills. Adding to this 0.3 mill for maintenance and operation gives 9.5 mills (nearly a cent) per kilowatt hour as the probable minimum true cost of hydroelectric power from the TVA when the system is fully loaded.

If operated purely for power purposes the primary power capacity of the Tennessee River plants could be increased by daily storage, but, being primarily for navigation, the continuous stream flow cannot be interfered with as would happen with such daily storage. For the same reason these dams could not be used for flood control.

TENNESSEE RIVER DAMS

From page 279 Testimony before Appropriations Committee: First Deficiency Appropriation Bill 1936

Main Stream Dams (Order of Dams follows Stream Flow)	1. Estimated Cost	2. Continuous Power Corresponding to Regulated Flow (Kw) (Table IV Special Report to Congress by TVA, Mar. 30, 1936)	3. 75% of Cost Allocable to Electricity (75% of Col. 1)	4. Cost per Kw of Firm Power (Col. 3 divided by Col. 2)
1. Coulter Shoals	$24,400,000	11,000		
2. Watts Bar	40,800,000	51,000		
3. Chickamauga	41,500,000	50,000	(This allocation is 75% of cost for the entire group of 8 dams. It varies somewhat for each individual dam.)	
4. Guntersville	37,600,000	45,000		
5. Wheeler	39,700,000	66,000		
6. Wilson	53,200,000	122,000		
7. Pickwick	35,800,000	76,000		
8. Gilbertsville	87,000,000	81,000		
	$360,000,000	502,000	$270,000,000	$537 (wtd. av.)

Now let us see what, in the present state of the art, the TVA can do *now* with a steam power plant to manufacture the same quantity of electricity. The data I have used for this computation represent conservative present-day practice. I have visualized a 100,000 kw coal-burning plant consisting of two 50,000 kw generating units and an outdoor substation, all of which would cost about $9,000,000 or $90 per kilowatt. This plant would generate steam at 850 lb per sq. in., with a temperature of 900 deg. F, and at a 50 per cent annual load factor would turn out a kilowatt hour from 12,500 heat units, which can be obtained from about 0.89 of a pound of your good West Virginia coal. I have further assumed that this coal can be delivered in the Tennessee Valley at $4.00 per ton, and have used the same 50 per cent load factor and 7½ per cent fixed charges as were used in computing the hydroelectric costs.

Without burdening you with the detailed computations, which are however, quite simple once the basic data are settled on, the total cost per kilowatt hour from such a steam plant, both fixed charges and operation, would be 3.92 mills per kilowatt hour.* This figure is about 41 per cent as large as the true cost of firm hydro power from the TVA "navigation" plants as projected.

*Taking charges as in TVA Report..Interest 3½%
Depreciation 3 %
Taxes 1 %
7½%

50% Load Factor makes 4,380 hrs. use per annum
Investment $90 per kilwatt

1. Fixed Charges 7.5% x $90 / 4380 = 1.54 mills per kwhr.
2. Fuel $4.00/2000 x 12500/14000 = 1.78 " " "
3. Operation and Maintenance .60 " " "
Total=3.92 " " "

The hydro plants, would of course, have additional "dump" power at certain seasons of the year, but such power could not be depended upon for continuous operation, unless relayed by steam power which would stand idle during such seasons. This makes the net value of "dump" hydro very small; if sold unrelayed it could not bring over 1¼ mills per kilowatt hour.

Looked at, therefore, from the viewpoint of cost, modern steam practice is a much cheaper way to produce electricity than that chosen by the TVA, and, from the viewpoint of society as a whole, the use of coal (with its extremely high labor content) to produce steam will help much more in solving the unemployment problem than water power development, where the use of labor is at a minimum.

I should not leave this subject without stating that the hydroelectric costs I have computed for TVA, although based throughout on official data, are not what that organization reports to the public.

While the figures I have used in my computations respecting the Tennessee River dams are all well known to the TVA, that body has not, up to the time of its last public report (for the fiscal year 1936), seen fit to allocate one cent of the cost of construction of any of its dams to electricity. This may be due to the legal situation surrounding TVA, for, of course, to the lay mind at least, it might seem somewhat inconsistent to talk about electric power being a mere "incident" to navigation, when in fact it represented three-quarters of the investment cost. Their reluctance might also be due to the relatively poor economic showing I have indicated of Tennessee River hydro compared to modern steam power production with coal. Whatever the reason, I feel the business men of West Virginia should know the economic facts of the situation.

The Objective Rate Plan—A Review

The Objective Rate Plan. By Wm. F. Kennedy X + 83 pages, $1.25. Columbia University Press, 2960 Broadway, New York, N. Y.

COLUMBIA UNIVERSITY PRESS has recently published a book by William F. Kennedy on the Objective Rate Plan which is the first publication on this subject, other than articles appearing in the trade press. Mr. Kennedy started the study of the Objective Rate Plan in March, 1936, as a Master of Arts thesis and report in Professor James C. Bonbright's seminar in Public Utilities at Columbia University. Mr. Kennedy revised the original report late in 1936 in order that more recent figures might be included. At the time Mr. Kennedy made his study, the only source of adequate statistics on the Objective Rate Plan was The Commonwealth & Southern Corporation, a subsidiary of which introduced this plan for residential electric service in October, 1933.

Mr. Kennedy points out that the Objective Rate Plan is one of the most important developments in recent times in public utility ratemaking. While its most common application has been in the field of residential electric service, it has also been applied to commercial electric service, domestic gas servic and one company has used it for street lighting service.

Mr. Kennedy's book is divided into five main divisions, namely:

1. Background of the Plan
2. Development of the Plan
3. Results under the Plan
4. Discrimination under the Plan
5. Appraisal of the Plan

Mr. Kennedy fully describes what the purpose of the Objective Rate Plan was as originally introduced by Alabama Power Company and its relation to the general subject of promotional rates. He shows by charts and figures how the plan was developed, the details of its application and the variations which have been worked out since its adoption by Alabama Power Company in October, 1933, by

(*Continued on page* 196)

Group Meeting of Engineering Committees

Wide Interest Reflects Expanding Engineering Activities

Alexander Maxwell
Director of Engineering

THE five engineering committees of the Institute held their annual group meeting in Chicago during the week of May 3, the total registration at this meeting exceeding 300, and the attendance at individual committee meetings was greater than ever before in the history of the Institute.

An innovation for the engineering committees was the dinner meeting held on Tuesday evening where addresses were made by B. F. Weadock, Vice-President and Managing Director of the Institute, and B. S. Rodey, Jr., Associate Controller of the Consolidated Edison Company of New York.

Mr. Weadock, in addressing the group, pointed out that this industry had a record of accomplishments and achievements, and that in spite of all the sensational headlines which had been written of a few errors and mistakes of the past, the industry had a sounder record of finance, growth and operation than any other industry in this country. The engineers were responsible for the birth and development of the industry. With expanding loads and an ever increasing demand to obtain more for each dollar expended, both for capital and operation, the engineer's responsibility will become ever increasing and the demands made upon him for producing new plant and getting more out of existing plant, will exceed any that had been made upon him at any time previous.

Mr. Rodey presented a paper entitled "The Engineers Interest in Utility Plant Accounting." The Accounting Committee has worked for a number of years on unified classification of accounts. The Federal Power Commission, by its order of June 16, 1936, amended December 31, 1936, adopted, effective January 1, 1937, a Uniform System of Accounting for Public Utilities, and Licenses subject to the provisions of the Federal Power Act. Substantially this same system of accounting was adopted by the National Association of Railroad and Utility Commissions at its annual convention in Atlantic City, November, 1936.

Mr. Rodey, in his presentation, showed the necessity for cooperation between the engineer and the accountant in following the requirements laid down for utility accounting. This system very definitely sets up items which must be charged to capital, items which must be charged to depreciation, and those which must be charged to maintenance. In certain cases the provisions are such that they may influence the actual engineering design of particular parts of the utility system.

In conclusion Mr. Rodey stated—"I am sure that the accountant is most happy to share wholeheartedly the solution of this problem with the engineer."

Discussions of this subject held in the individual committee meetings showed that the engineers were ready and anxious to cooperate with the accountants in the working out of this subject. Each committee is planning individually to give the necessary attention to this matter in its work for the year 1937-1938. Brief accounts of the individual meetings follow, while more extensive discussions appear on other pages.

Accident Prevention Committee

The Accident Prevention Committee meeting Monday and Tuesday had the largest attendance of any meeting since its organization about three years ago. Four new members had been added to the committee since its last meeting, all of whom were present. Rather extensive reports were presented, followed by discussions, on low voltage hazards, accident statistics, employee health, linemen's rubber protective equipment. Progress reports were made on interlocking and hold-off, revision of tree trimming practices report, traffic hazards, public safety and cooperation with other groups in safety work. The committee took action recommending the reprinting of NELA Publication No. 289-70, a booklet giving the standard technique for resuscitation in gas poisoning, electric shock and drowning.

Electrical Equipment Committee

The Electrical Equipment Committee held its meeting Monday and Tuesday. The total attendance at this meeting was about 75. At the first session of the meeting, which was confined to committee members, a discussion of apparatus and system failures formed a major basis of the program. This detailed discussion of difficulties encountered is of great value to the committee members in correcting similar difficulties on other systems before any interruptions to service occurs.

With increasing system loads the subject of load forecasting and fundamental system planning is again forming a major part of the work of this committee. Papers by Messrs. Hester, Hentz and Gross showed the various methods used by their respective companies for determining the loads which the systems will be required to carry a few years in the future so that the plant will be available to meet demands on it and so that large capital expenditures will not be made until they are necessary.

A symposium on drying out and rehabilitation of electrical equipment submerged by flood also formed a very important part of this committee's work. Papers were presented giving the results of experience of the flood in the Ohio Valley, both by the operating engineers and the engineers of the larger manufacturing companies. These papers cover the experience obtained in the salvaging of every conceivable form of electrical equipment, ranging from the small parts of the domestic meter to some of the largest turbo alternators. It is expected that this symposium will be of great value in the future to utilities confronted with similar problems.

Hydraulic Power Committee

The Hydraulic Power Committee held an inspection trip on Sunday when visits were made to the plant of the Woodward Governor Company at Rockford, Illinois, and the Lockport plant of the Chicago Sanitary District. At the Woodward plant the committee members had an opportunity to see some of the most recent developments in the refinement of governor control of the prime movers for electrical equipment. With increasing requirements for frequency stability, tie line loading, the

importance of accurate governor characteristics is ever increasing.

Prime Movers Committee

The Prime Movers Committee met on Monday and Tuesday with a total attendance of about 50. The major business carried on by this committee was a review and approval of the various reports which the committee has prepared. The committee has approved and referred to its Editing Committee reports on boilers, turbines and condensers, combustion, oil and gas engines, chemistry, power station data.

Transmission and Distribution Committee

The Transmission and Distribution Committee met on Wednesday and Thursday, in what was one of the best attended meetings that has been held. Those present included numerous engineers from power companies in the middle west, members of other committees and several manufacturers' representatives.

A plan of allowing one afternoon of the two-day meeting for selected subject sessions, initiated at the previous meeting, was followed at this one. Two such sessions were held; one of these sessions was held by the Underground Group at which several papers relating to underground problems were presented and discussed. The other session dealt with informal discussions on coordinating protection of persons, equipment, and service.

The three sessions of the main committee were given over to scheduled papers and discussions on voltage, line outages, and service continuity, experience in recent floods, standards and specifications, distribution transformer loading, zinc coating on steel wire, expulsion gap experience on transmission lines, and a study of operating records on 110 and 132 kv lines.

In addition to these papers and discussions the committee approved suggested specifications for pin type insulators and certain items in pole line hardware. These had been previously submitted to the members of the committee by letter ballot and had received a large affirmative vote.

Prime Movers Committee Meeting

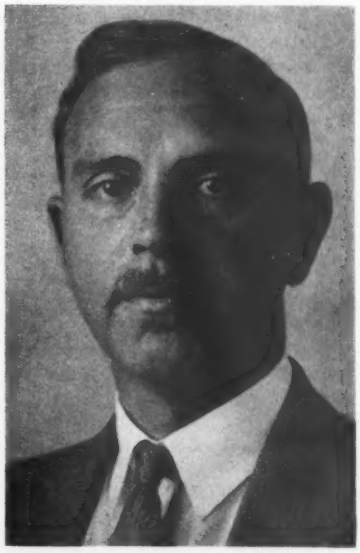
P. W. THOMPSON, *Chairman*

THE Prime Movers Committee met in Chicago at the Edgewater Beach Hotel on May 3 and 4.

As this was the last meeting of the current year most of the time was consumed in reviewing the various technical reports issued annually by the Committee. Reports referred to the Editing Committee for editing and publication were those on Boilers, Turbines and Condensers, Combustion, Oil and Gas Engines, Chemistry, and Power Station Data.

An interesting excerpt from the Boiler Subcommittee Report pertains to figures which fairly well represent the trend of boiler orders during the past year. The Combustion Engineering Corporation statement mentions that of 41 large high pressure units recently built or under construction 35 are of the multi-drum, bent tube type, and 6 are of the straight tube sectional header design. Of the pulverized coal fired boilers approximately 60 per cent employ the dry bottom furnace and 40 per cent the slagging bottom. Data from the B & W Co. report is as follows:

Steam Capacity Range, Pounds per Hour	*No. of Boilers*	
500,000 and over	7	
400,000 to 499,000	3	
250,000 to 399,000	13	
Less than 250,000	34	
Design Pressure, Pounds per Sq. In.		*For Superposition*
Over 1000	11	9
650 to 999	25	2
Less than 650	21	0
Steam Temperature		*With Superheat Damper*
900 to 950	20	20
825 to 899	11	7
700 to 824	22	8
Less than 700	4	0
Type of Furnace		
Slag type	22	
Hopper Bottom	9	
Rake out ash removal	1	
Stoker	9	
Oil and/or gas	16	



MR. THOMPSON

Mr. Croft reported that since 1936 they have been operating at Rochester with 100 per cent make-up on a 700 lb, 770° boiler, and feel the operation is entirely satisfactory. Mr. Croft would be glad to go into their practice more in detail with anyone who cares to visit him at Rochester.

One interesting item in the Turbine Subcommittee Report was the reported test performance on the Port Washington 1200 pound turbine of 8,500 Btu/kwhr as compared to the guarantee of 8,715 Btu/kwhr.

The 1000 degree Delray experimental turbine has been discontinued to make way for further expansion of the Delray plant. The parts of the turbine are being very carefully measured for whatever information they may reveal.

Professor A. G. Christie requested that any Committee members having ideas for a model smoke law or suggestions which otherwise would be helpful to the newly created ASME Smoke Committee, of which he is Chairman, should write him.

A number of individual member problems were discussed. Particular interest in the Committee centers at the present time in the design and operation of high pressure, high temperature plant.

Inspection trips were made to Superheater Company, Crane Company, and to Fisk Street Station.—J. N. LANDIS.

Accident Prevention Committee Meeting

THE Seventh Meeting of the Accident Prevention Committee was held on May 3 and 4 at the Edgewater Beach Hotel in Chicago during the annual group meeting of the engineering committees of the Institute.

This meeting was featured by a large attendance of the membership and visitors. Among the latter were Messrs. Charles B. Scott, Bureau of Safety, Chicago, for many years chairman of the Accident Prevention Committee of the former N.E.L.A., J. C. Martin, Bureau of Safety, Chicago, a former chairman of the Inductive Coordination Committee of the former N.E.L.A., and W. Dean Keefer, Director Industrial Division, National Safety Council, Chicago. It was brought out in the course of the meeting that those present represented companies whose employees totaled approximately 150,000, more than one-half of the employees of the entire industry.

It was also the first meeting attended by the new members of the committee, Messrs. E. C. Rue, Edison Electric Illuminating Co. of Boston, L. M. Shadgett, Georgia Power Co., Atlanta, D. C. Stewart, Buffalo Niagara & Eastern Power Co., Buffalo, and A. P. Thoms, Commonwealth Edison Co., Chicago. Mr. Shadgett has accepted the vice-chairmanship of this committee.

A progress report was made on the various aspects of low voltage hazards. Preliminary statistics on low voltage shock cases that have occurred throughout the country and Canada during 1935 were given. These data were based mostly on newspaper clippings received from press clipping bureaus throughout the country, and therefore do not necessarily include all shock cases that occurred. This is particularly true for the cases in Canada. There was also given a summary of some data on fatal electric shock cases in the State of New York, exclusive of the five counties comprising Greater New York City, for the years 1925 to 1931 inclusive. The discussion on low voltage hazards also covered the electrification of wire fences on farms. This continues to be a subject of general interest throughout the country. Although the situation has not changed materially during the past year, there is evidence that the practice is being considered with more caution than previously. Two or three states were reported to have prepared and issued rules governing the use of control devices to limit voltage and current within supposedly safe limits on fences. There is apprehension on the part of many that should these control devices become inoperative or defective they are likely to be bridged, thus connecting the fence temporarily directly to the utilization circuit and thereby creating a hazardous situation.

W. A. BUCHANAN, *Chairman*

MR. BUCHANAN

Reference was made to the pamphlet entitled "Your Unseen Helper" which had become available in final form since the last meeting of the committee. This pamphlet is based on 12 precautions that should be observed to avoid electric shock from lighting and appliance circuits. This booklet sells at a nominal price when purchased in quantities and is available through the General Office of the Institute. According to recent information, the sales thus far total approximately 900,000 copies. Mention was also made of the pamphlet entitled "Do You Know?" which is of a similar nature, but which was published several years ago by the Accident Prevention Committee of the former N.E.L.A., primarily for use in guarding against electric shock from utilization voltages in industrial plants. Information regarding these two publications may be obtained through the General Office.

A brief progress report was presented on Interlocking and Hold-Off. Owing to changes in personnel and assignments, the expected progress in this has not been made. It was pointed out because of the nature of this subject, it would not be possible to develop a detailed operating procedure that would be applicable generally, due mainly to the variations in company practices. Therefore, the final report on this subject will consist of fundamental principles of safety from which any company can develop detailed company rules that apply to its own conditions.

The report on employee accident statistics told of the status of the work that is being done by a Sectional Committee of the American Standards Association, to prepare methods for compiling industrial accident statistics. It was explained that the work of this Sectional Committee as it stands at present is more detailed and elaborate than is necessary or desirable for reporting employee accidents of power cmpanies. However, it was expected that the application of these methods for power company use could be modified to permit taking advantage of those parts which are particularly adaptable to the electric light and power industry in compiling employee accident statistics.

Reference was made to an article that appeared in the January EDISON ELECTRIC INSTITUTE BULLETIN which gave a summary of the causes and location of power company employee accidents, based on approximately 160,000 man-years. This gave the relative number of accidents that occurred in the various departments of ordinary power company operation. Reference was also made to the industrial fatalities statistics of the Division of Statistics and Information of the New York State Department of Labor in which it was pointed out that of a total of 6884 industrial employee fatalities for the five-year period ending with 1936, 157 occurred to employees of public utilities. As these data were available only in summary form, it was impossible to segregate these 157 cases between the various utilities. It was also pointed out as a matter of interest that data obtained from the Bureau of Census of the Department of Commerce, gave the total deaths due to electric current in the entire United States for the five-year period ending with 1934, as 3853, an average of 771 per year. This same source of information gave the total number of deaths due to lightning for this same period as 1979, approximately one-half as many as the total number of deaths due to electric current.

The problem facing the industry with regard to rubber protective equipment is mainly what can be done in the way of

providing safety to workmen on distribution circuits of the 6.6, 11 and 13 kv classes which cannot be de-energized or interrupted because of service conditions. Heretofore rubber gloves of suitable quality had been recommended for use on circuits up to and including approximately 3000 to ground. Because of the quality which has been available within recent years, some companies have found it possible, with proper care in testing and inspection, to use these gloves on circuits for somewhat higher voltages. The recommendation of this committee with regard to the rubber gloves available at the present time, remain unchanged although it was recognized that safe working methods on the higher distribution voltages should be developed if possible.

A progress report was presented on the revision of N.E.L.A. Publication No. 110, entitled "Tree Trimming Practices." A preliminary draft for comment had been distributed to members of this committee and to members of the Transmission and Distribution Committee with whom this committee is cooperating in the revision of the report. A copy of the revised report is being sent to the various commercial tree trimming companies for such suggestions as they may wish to offer. It was explained that this report was originally prepared jointly by the Accident Prevention Committee and the Overhead Systems Committee of the former N.E.L.A., since the subject involves problems with which distribution engineers are concerned. It is expected that the report will be published within the next few months.

The interest of this committee in highway lighting was explained by the chairman, who said that there are certain aspects of the problem in which the Accident Prevention Committee should be concerned because of its interest in safety problems touching the operation of the electric utilities. It was recognized that the subject contains aspects that are outside the scope of this committee and therefore its work should be in the nature of participation with other interested agencies in dealing with safety problems involved.

There was an interesting discussion on traffic hazards which centered about the use of governors on company fleet vehicles. No new developments were brought to the committee's attention and the situation stands at present with companies who are using governors on their vehicles endeavoring to secure experience data from which their future practices may be determined. The discussion brought out that there are advocates both for and against the use of governors and it does not appear likely that a uniform practice will develop which will be applicable to all companies. In connection with the discussion on this subject, one of the members discussed tests that they had made on company drivers, and it had been found that these tests showed a substantial number with defective vision. It was the consensus that it might be advisable for power companies in general, who had not done so, to investigate this matter with a view to improving or correcting the vision of company drivers.

No report was submitted on office hazards, although discussion of the subject brought out that considerable attention is being given to the surfacing of office floors to prevent accidents due to falls. Various companies reported that they are studying the subject with a view to developing a surfacing material for linoleum that will be more satisfactory. It was expected that some definite information on this subject will be available at the next meeting.

A report was submitted on Resuscitation which included a description of certain modifications of the Schafer Prone Pressure Method or resuscitating persons who had received electric shock. Following an extended discussion, the committee reaffirmed its former recommendation regarding the technique of the Schafer method and its recommendation with regard to the use of mechanical devices in connection with resuscitation. (See *N.E.L.A. Bulletin* for April, 1930, and E.E.I. BULLETIN for January, 1936.)

A progress report was presented on Employee Health which explained what the Health Subcommittee had done to date. It was pointed out that although a great deal of work had been accomplished, the studies they plan to pursue have in reality only started. It is an extensive subject and touches on many problems of importance to the electric utility industry. It was again brought out in discussion that the lost time due to illness is upward of ten times that due to accidents, and that it is essential that the electric utility industry give serious consideration to the health of its employees. The Health Subcommittee on this problem includes several power company physicians who are handling this subject within their respective companies, and it is expected that eventually a helpful report will be available. It was pointed out that it would be helpful if the committee could have the names of member company physicians in order that their advice may be sought on employee health problems, and also to permit placing the information now available in their hands for such use as they may wish to make of it.

A brief report was submitted touching on the hazards to the public at hydroelectric plants. This hazard is due largely to fishermen and others who may be in boats below power house dams. There is danger of drowning because of the sudden rush of water following the automatic opening of gates when turbines are placed on the line to meet sudden increases in load. It was the consensus that about all that can be done in this direction is to continue educational work as effectively as possible, as those concerned are generally in no way connected with the operation of hydroelectric plants and therefore quite unfamiliar with their methods of operation and the hazards involved.

Hazards arising from the use of CO_2 equipment is a comparatively new assignment and only a progress report was given. The results of some tests made to determine the effects on persons in the use of CO_2 equipment in extinguishing fires were described, and also several accidents involving this type of fire fighting equipment were mentioned. The sponsor of this assignment was requested to continue the study with a view to making a final report at as early a date as possible. The discussion indicated that this subject is receiving attention by several companies.

Wood Pole Conductivity has several aspects of importance to power companies. It was the consensus that so far as the safety to workmen is concerned, no distinction should be made between the various species of timber used for poles. The discussion brought out that many companies have conducted tests of one kind or another to determine the resistance of wood poles, and in all of these it was evident that such a wide variation had been found, even under almost identical conditions, that it would be unwise to attempt to designate the conditions when a workman might depend upon the insulation of the pole for safety.

A change in sponsorship on Cooperation With Other Bodies has made it impossible for anything other than a brief progress report to be made. Cooperative efforts are being continued with the American Institute of Electrical Engineers, the American Society of Safety Engineers and others with a view to coordinating efforts mainly along the line of safety education.

Electrical Equipment Committee Meeting

J. F. Fairman, *Chairman*

THE spring meeting of the Electrical Equipment Committee was held at the Edgewater Beach Hotel, Chicago, Ill., on May 3 and 4. This meeting was coordinated with meetings of the other engineering committees of the Institute. About 30 members of the committee and approximately 50 visitors were present.

A closed session of the committee was held Monday morning. At this session the report on apparatus and system failures was presented and discussed in detail. This report summarizes the important failures which occur on electrical systems and has been very valuable to the members in learning in advance of weaknesses of equipment and measures that can be taken to prevent a similar failure on another system. Another important function is the bringing to the attention of the manufacturers inherent defects in design or construction of particular lines of equipment, with resultant improvements.

The Meter Subcommittee reported that progress had been made in the preparation of a new meter handbook although the manuscript will not be completed for several months. The meter manufacturers have developed a new line of 15 ampere and 50 ampere meters with improved characteristics both for light load and for overload. The cost of these meters has been reduced below the previous price for similar ratings, and it is hoped that this development will substantially simplify the problem of metering loads at secondary voltage. The committee also approved the Meter Committee's recommendation that watthour meters carry a single voltage rating, namely, 120 volts instead of the dual rating of 115/120 for the two-wire meter and integral multiples for other ratings.

Mr. Fields presented a paper describing the modernization and expansion program which has been in progress on the Cincinnati Electric System over the past several years. This program involves the installation of a 35,000 kw topping turbine at the present time and plans for a second similar turbine at a future date. A 65,000 kw condensing turbo system is also being added to the system at this time. The interconnections of this system with neighboring

MR. FAIRMAN

utilities proved of great value during the recent flood and studies are being made of the possible extensions of these. Within the system additional 66 kv overhead transmission lines, as well as 66 kv cables are being installed. Modifications are being made in switching stations and substations to increase the use and reliability of equipment.

The subject committee on Generator Insulation reported that considerable progress has been made. The committee has had the opportunity of testing the generator windings of a number of old machines to destruction. This information will prove of great value, not only in determining the future trends of generator insulation, but also in determining proper tests to be made on reconditioned or repaired equipment.

All utilities make a practice of serving large customers at primary voltage. These primary substations are generally installed at the customer's expense. However, the utilities are frequently called on to aid in the layout and design of the substations. Also, certain precautions must be taken so that the equipment will not interfere with the service to other customers. Papers describing customer substations were presented by representatives of the Dayton Power and Light Company, Detroit Edison Company, Cleveland Electric Illuminating Co., Commonwealth Edison Company and the Philadelphia Electric Company. All of these papers pointed out a wide variety of station layout and equipment that was used to meet the varying conditions.

Papers giving the load forecasting methods used by the Commonwealth Edison Company, Philadelphia Electric Company and the Duquesne Light Company were presented and discussed. These papers emphasize the need for load forecasting but also pointed out that the best forecast was merely a look into the future using all available knowledge and experience to temper the judgment as to trends. The discussion also emphasizes the necessity for developing a fundamental system plan and fitting each step of system development into this ultimate plan. The necessity in any development to provide for places in the construction where the work could be temporarily suspended without serious loss, was brought out by a number of the members in the discussion.

In view of the many floods which have occurred in the last year the committee arranged a symposium to collect together the experience of utilities and manufacturers in methods for coping with flood situations and for rehabilitating electrical equipment which had been submerged. This symposium was made up of papers giving experience of the Cincinnati Gas and Electric Co., the Louisville Gas and Electric Co., the Westinghouse Company, the General Elec. Co., and the Allis-Chalmers Co. It is believed that the availability of this symposium to others who may at any time be confronted with similar problems will prove of great value in making plans for combating such situations and also for restoring the vital electric service after the high waters of the rivers have receded.

This was the closing meeting of the present administrative year. The committee work has been organized so as to continue through the summer, and the next meeting probably will be held in early October.

Transmission and Distribution Committee Meeting

P. H. Chase, Chairman

ONE of the most interesting and well attended meetings of this committee since its organization was held at the Edgewater Beach Hotel in Chicago on May 5 and 6. Approximately 140 people were in attendance.

Two Subject Sessions were held on the afternoon of May 5. One of these was under the leadership of Nicholas Stahl, on a group of subjects under the heading, "Coordinating Protection of Persons, Equipment and Service." The other Subject Session was presided over by G. B. McCabe. Inasmuch as the subject session presided over by Mr. Stahl included consideration of safety to persons, an invitation had been extended to the members of the Accident Prevention Committee to attend and participate in the discussion. Several of the members of that committee were present and participated in the discussion on several of the topics on the program. The results of this cooperative consideration of the subjects involved were gratifying to the officers of both the Accident Prevention Committee and the Transmission and Distribution Committee.

The program for the Underground Group subject session included four papers. The first, by G. B. McCabe on "Electrolysis Mitigation in the Principal Cities of the United States" covered methods of draining cable and pipe systems, methods of controlling cathodic corrosion, and practices concerning the formation of electrolysis committees. Next a "Progress Report on New Tests for Uniformity of Cable Insulation" was presented by K. S. Wyatt. This work covers an investigation of the relationship between mechanical non-uniformities in cable insulation and electrical properties. The investigation has developed new test methods and instruments, chief among which is a method of preserving mechanical non-uniformities in test samples by the use of styrene. The other papers were presented by W. B. Elmer and C. W. Pickells. Mr. Elmer's paper covered a recommended method of making duct temperature measurements and a discussion of the methods now in use by various utility companies. Mr. Pickell's paper, which was presented by J. A. Brooks, described a performance specification drawn up by the New York and Queens Electric Light and Power Company for non-metallic sheathed cables for underground network mains and included an analysis of the data obtained from the prescribed tests.

MR. CHASE

The Subject Committee on Underground Methods and Accessories, which was organized at the Philadelphia meeting last January, held its second meeting of the year on Tuesday afternoon, May 4. Investigations initiated at the Philadelphia meeting were reported upon and new subjects for investigation were discussed. The latter part of the meeting was devoted to a general discussion of underground system problems.

The general subject of "Voltage" was discussed in several of its aspects from the distribution point of view. A report of the Utilities Coordinated Research, Inc., on the subject of "Lamp Flicker" was presented briefly by Stanley Stokes. He brought out several interesting points that had been investigated in this research which it is expected will be available in published form, probably sometime during the fall. A paper was presented by Messrs. C. P. Xenis and W. Perine, both of the Consolidated Edison Company of New York, Inc., on the subject of "A Lamp Flicker Slide Rule" which may be used to ascertain those values of voltage fluctuation and frequency of occurrence which will in general produce perceptible or objectionable flicker. It was brought out that with the widespread use of electrical distribution systems in common for power and lighting loads, the problem of lamp flicker has become serious with many companies. The operation of welding equipment and motor driven reciprocating equipment on combined systems may affect the quality of lighting, because of the voltage variations which these types of equipment produce, unless adequately provided for by design in both the equipment and the distribution systems. Obviously, lamp flicker in itself cannot be be completely eliminated, hence the problem is one of approaching suitable threshold values where flicker will not become objectionable from the lighting standpoint.

There was also presented a paper entitled "Periodic Voltage Survey as a Basis for Distribution Design." This was presented by Messrs. R. W. Burrell and W. E. Appleton of the New York and Queens Electric Light and Power Company. This paper pointed out that as voltage regulation is one of the chief factors influencing distribution design, data obtained in a survey should carry considerable weight in making decisions with regard to the re-design of existing distribution systems, the extension of new circuits, additional transformers, regulating equipment, etc. With the present-day load building campaigns being conducted, there is more need for distribution engineering information than ever before. The distribution engineer's problems in maintaining high standards of voltage regulation are very complex and voltage surveys are useful in solving these problems.

In a series of papers on "Line Outages and Service Continuity," Herman Halperin of the Commonwealth Edison Company, Chicago, gave some Observations in Connection with Cooperative Survey of Troubles on Distribution Systems. He pointed out that several years ago operators of underground power cable systems in this country decided it would be to their mutual advantage to

keep service trouble records on a uniform basis. Through this means a considerable amount of reliable operating data are being obtained which are extremely valuable in solving some of the problems encountered in underground distribution. He pointed out that work of this kind makes it obvious that operating records and resultant studies are valuable in the development of economic designs, in assisting management to get a better picture of the general characteristics of the system, in the determination of desirable maintenance work and in pointing the way to investigations and further improvements.

A paper on Trouble Analysis and Power System Economics was given by W. B. Elmer, Edison Electric Illuminating Co. of Boston. He said that while it is true that most machines owe their improvements to the study of their faults, this process has not yet been applied with full effectiveness to electric power systems from the economic standpoint. The specific method of tabulating distribution system troubles described in Mr. Elmer's paper has been developed through the cooperation of a group of the larger power companies, and it was his opinion that the tabulation of this or similar schemes by more companies would prove to be of value, and will provide a source of data by means of which the industry may make improvements in and constructive comparisons of different power distribution engineering and construction methods. Considering the expenditures now made to safeguard service reliability, it is reasonable to believe that a small proportion of this amount spent to direct these expenditures should be a paying investment.

Messrs. J. A. TenBrook and A. H. Kidder, both of the Philadelphia Electric Company, presented a paper on "A Simplified Primary Network." They pointed out that the current trend to increasing the use of electricity and the corresponding demand for lower rates has resulted in pressure on the distribution engineer to work toward two objectives that are somewhat in opposition to each other. Service reliability is considered of so much importance that it is one of the prime considerations upon which distribution systems are designed. However, to obtain a high degree of service reliability in many instances requires extensive expenditures and it is between the limits of providing good service and wisely expending the management's funds that the distribution engineer must work. The simplified primary network is but one of possible methods for improving service continuity in a distribution system. It is, however, especially well adapted for use in areas now served by small, single bank substations. The presentation of Messrs. TenBrook and Kidder outlined a method which had been given a two years' trial in an area of 21 sq miles with 44 miles of 4 kv circuit exposure, and a load of 730 kv-a. The coming year will see this trial area extended to include 31 sq miles of territory, 80 miles of 4 kv circuit, and a load of 2900 kv-a.

It was stated that two years' experience on small trial network is not of itself complete, or necessarily representative of that to be expected under other conditions. However, when weighed in the light of available fault test data and comparable experience in other parts of the primary distribution system, the performance of the trial network has been about what was expected. The most important result of this work has been the growing conviction that there are no insurmountable difficulties in the way of inexpensively effecting a material reduction in customer's outages.

An interesting account of the glaze storm that occurred throughout a large section of the middle west during January was reported on by Stanley Stokes, who had been requested by Chairman Chase to secure information from operating companies throughout the region where this storm occurred. A map was shown indicating the areas where the heaviest damage had occurred as well as where less damage had resulted to overhead lines and in impaired service. Practically all who had furnished information to Mr. Stokes reported that the major damage resulted from trees which were carried down or into the lines by ice loads. Apparently there were no high winds during the time that ice was on the wires. A few instances of dancing conductors were reported. As a matter of interest Mr. Stokes showed a motion picture film which showed dancing conductors. The conditions shown in this film did not, however, occur during the storm which Mr. Stokes described but had been taken previously.

C. P. Xenis of the Consolidated Edison Co. of New York, Inc., presented a paper on "Short Circuit Protection of Distribution Networks by the Use of Limiters." Mr. Xenis pointed out that companies operating extensive distribution networks have experienced cases of cable failure "spreading" beyond the initial point of fault, and the prevention of extensive damage in such cases depends on the prompt arrival of the operating crews who cut the network cables around the faulted area. This problem is not new and the development of noncombustible cable insulation represented one angle of attack; another is the development of cable, joining connectors, lugs, etc., which incorporate fusible elements, so that in addition to their normal splicing functions, they provide adequate fuse protection to the cables to which they are attached.

The Limiter consists of a reduced metallic section incorporated in a connector, lug, or other connecting device used in normal cable installation procedure. It has a time-current characteristic calculated to protect the cable to which it is connected over a wide range of short-circuit currents, by interrupting the faulty circuit before the cable insulation reaches the "roasting" point. It is so designed as to form an integral part of the joint or cable terminal without the necessity of the additional enclosures, terminal blocks, packing glands, etc., that conventional underground fusing systems require. In effect, it is a fuse made into an inconspicuous part of the cable it is intended to protect.

The subjects of joint use at higher distribution voltages, shielding by bonding telephone cables, and construction specification for power wires crossings with communication wires were briefly reported upon to give the status of these projects.

F. E. Sanford, Cincinnati Gas & Electric Co., gave an interesting account of the recent flood experience in Cincinnati. Mr. Sanford's talk was accompanied by a number of lantern slides showing the rise and recession of the flood in the territory served by his company. The electric system in Cincinnati, together with its sources of supply, was briefly explained and maps shown which indicated the location of generating stations, substations, and transmission lines. The operation of the system immediately preceding and during the flood period was described and an account given of the preparation which was made when it was evident that flood stages would be reached. It was Mr. Sanford's opinion that this advance planning had saved a great deal of equipment, had made it possible to serve their load with the greatest effec-

tiveness under flood conditions, and resulted in a more prompt restoration of service.

Alexander Maxwell gave a brief talk on the importance of engineers becoming better acquainted with the accounting procedure which the industry will be required to follow. It was explained that in some instances the new accounting system will vary from that used in the past and it will avoid confusion on the part of both the accountants and the engineers if the latter acquire a working knowledge of the accounting system that will shortly be put into use.

Two interesting papers were presented by the Standards and Specifications Group. L. B. Harvey, Porcelain Insulator Corp., talked on Insulator Standards from the Manufacturer's Point of View, and J. T. Lusignan, Ohio Brass Co., gave an interesting talk and demonstration on Testing Insulators for Corona and Radio Interference.

Two Suggested Specifications which had been in the course of preparation for several months and which had been submitted to the membership for comment were approved by the committee. The first of these was a "Suggested Specification for Low and Medium Voltage Pin Type Insulators," the other, a "Suggested Specification for Bolts and Nuts." Both had been submitted for letter ballot to members of the committee and had been voted upon affirmatively by a large majority of the committee membership. A brief report was also presented by L. G. Smith summarizing the treating data which he had collected on pine poles.

A progress report was made on the work which has been underway in revising the Suggested Specification for Wood Crossarms. Also a progress report was given on the ASTM Tentative Specification for Hard Drawn Copper Transmission Cable, and on primary fuses, a subject which has engaged the attention of this committee for the past two or three years.

H. W. Eales reported briefly for the Special Radio Committee giving the status of the application of the electric light and power industry for radio frequency allocations. As yet no definite action has been taken on this application and the matter is still pending before the Federal Communications Commission.

A series of interesting discussions was given on a program that had been arranged by the Overhead Distribution Group. Merrill DeMerit gave a talk on Distribution Transformer Loading which was accompanied by numerous lantern slides. This dealt largely with the results of surveys that had been made to determine the proper size and spacing for overhead distribution transformers. H. P. Seelye followed this with a talk on the same subject in which he pointed out the important part which transformer loading plays in the economy of operating a distribution system. The most economical condition is achieved when the transformers are carrying all the load which they can sustain without damage. In particular, there are a number of problems involved in determining just what the load is, its characteristics, how much will actually damage the transformers under different conditions, and what the nature and extent of the damage will be. Some of the fundamentals of the problem and the things which must be considered in studying it in connection with any specific system or kind of loading were given.

T. H. Haines discussed Distribution Transformer Load Testing. He described three ways in which load tests can be made by using clamp-on current transformers and ammeters, maximum ampere demand meters, and thermal indicating devices. Mr. Haines pointed out the conditions under which transformers should be tested, which led up to the adoption by his company of a systematic method whereby load tests on distribution transformers could be made.

A paper by Messrs. C. H. Lewis and E. H. Snyder, both of the Public Service Electric & Gas Co., on Distribution Transformer Load Supervising Methods was presented by Mr. Lewis. This paper dealt mainly with a study of the practical viewpoint of loading transformers in accordance with their thermal rating. The authors did not recommend any particular method of load supervision as being greatly superior to any other. The emphasis should be upon the intelligent and persistent application of whatever system is best suited to local requirements rather than upon the details of the system itself.

A. H. Kidder, Philadelphia Electric Co., presented a paper on Simplified Calculations of Transformer Temperatures Under Variable Loading. Mr. Kidder pointed out that frequently the load carrying capacity of a transformer is limited only by the permissible maximum copper temperature. The pressing need for economies in electric distribution makes it increasingly important that transformers be operated more nearly at loads commensurate with their capacity under the particular operating conditions which obtain. This requires temperature calculations and apparently there is opportunity for a considerable degree of simplification through the use of a simple approximate instantaneous relationship which lends itself readily to fast step by step calculations.

The program presented by the Overhead Transmission Group consisted of a paper by F. M. Crapo, Vice-President and General Manager of the Indiana Steel and Wire Co., on the Crapo Process of Zinc Coating Steel Wire; a report on Expulsion Protective Gaps on Transmission Lines for 1935-1936, by D. M. Bunn; and a report on A Study of Operating Records on 110 and 132 Kv Lines, by Edwin Hansson. Mr. Crapo's paper is the fourth in a series on the zinc coating of wire which has been sponsored by the Overhead Transmission Group. Each of these has emphasized some process and the series taken as a whole should constitute a good symposium on the subject. This is a subject of considerable importance at the present time, inasmuch as some of the processes are relatively new and may alter to some extent the over-all use of iron and steel wire in the electrical industry. Mr. Crapo's paper, as did some of the others, dealt briefly upon the historical aspects of the subject and then described in detail the distinguishing features of the Crapo process. Mr. Bunn presented a report on the data he had collected from operating companies in the use of expulsion protective gaps during 1935 and 1936. The information which he had collected was tabulated and made available to members of the committee for further study. Mr. Hansson's report was a summary of information he had obtained through sending a questionnaire to members of the committee and tabulating the replies for use as a comparison of operating reliability of the various types of line design. The data cover 23 different types of construction, two or three types of which are in some cases employed in the same line. For these and other reasons, direct comparisons could not be made and furthermore conclusions would be difficult until additional data are obtained.

The Engineer's Interest in Unitized Plant Accounting

By B. S. Rodey, Jr.

Associate Controller, Consolidated Edison Company of New York, Inc.

Presented at the Joint Meeting of the Engineering Committees of the Edison Electric Institute, Edgewater Beach Hotel, Chicago, May 4, 1937

THERE is probably no subject, at the present time, in the Public Utility business that more uniquely involves the interest of both the Engineer and the Accountant than Continuing Property Records. Recent developments require that the dollars in the property accounts be associated with and related in detail to comparatively small units of plant and furthermore, that the changes in these plant units, due to additions, replacements, or retirements, be correctly accounted for as a routine matter. These basic requirements can only be accomplished by the Accountant with the full cooperation of the Engineer and his complete understanding of the fundamental accounting principles involved. It is the Engineer's responsibility to see that the pertinent facts in connection with the physical changes to the property are correctly reported to the Accountant.

MR. RODEY

Those familiar with the past history of Utility plant accounting are aware of the general theory of compensating errors, in the matter of failing to capitalize elements of cost which should have been capitalized on one hand, being offset by the failure to correctly retire or account for betterments on the other hand. The day has passed when the plant accounts can be adjusted on any such arbitrary theories or operated to meet the whims of a particular Accountant. It is now required that he have available sufficient pertinent facts on which to base his determinations. Notwithstanding the facts that accounting has never been and never will be an exact science and that there are definite economic limitations in maintaining plant accounts, present regulatory requirements and demands for accurate data for tax schedules necessitate a much higher degree of accounting accuracy than has heretofore been the case. In dealing with plant replacements the present demands for greater detail are due primarily to the necessity for distinguishing more accurately between charges to maintenance, to plant accounts for new construction, and to depreciation or retirement reserve.

Early Development of Plant Accounting

For many years both the Public Utility Companies and the various Regulatory Commissions have been engaged in the development of more adequate records supporting plant costs in an attempt to avoid the necessity of periodic extensive and costly inventories and appraisals in rate matters and also to provide the management with a greater sense of security in the soundness of their asset accounts. In order to arrive at a better understanding of the modern technique of plant accounting, it appears desirable to review briefly the historical background of the present developments.

The "Fixed Assets" of a Public Utility, which term represents the investment in assets of a relatively permanent character, have been variously characterized, in the Balance Sheet, as "Construction," "Plant and Property," "Fixed Capital," "Utility Property," "Operating Property," "Electric Plant," etc. For convenience, we will use the terms "Electric Plant" and "Electric Plant Accounts," as adopted by the Federal Power Commission in its Uniform System of Accounts, ordered effective as of January 1, 1937. The "Electric Plant Account" includes both Tangible and Intangible property.

The Tangible Property Accounts include the cost of all physical property. The Intangible accounts include, in general, costs of certain business assets, such as Organization expense, Patent Rights, Privileges, Franchises, etc.

The manner of recording the detail costs of Intangible Plant may be considered as purely an accounting problem for the reason that it does not directly involve the existence, location, or description of any physical items of real property or equipment. The substantiation for the costs of items of Intangible property must, of necessity, be based on voucher payment records or other purely documentary support. On the other hand, substantiating and recording the cost of Tangible Plant is, at the present time, both an accounting and an engineering problem as it involves paralleling, insofar as it is practical, accounting facts and records with the ever changing conditions of the physical properties to which they relate.

Probably, the first serious consideration given to detailed plant records arose in connection with studies on straight line depreciation or depreciation accounting. Such studies required details of the various property units owned, their related cost and age, and led to the development of Continuing Property Records, as generally understood and discussed at the present time by Public Utility people.

The term, Continuing Property Records, in itself, does not imply anything new in Public Utility accounting. Certain details of the cost of property in the way of chronological monetary entries, under brief captions and sometimes accompanied by a short explanatory description of the supporting asset items

have been maintained by most companies from the time of their inception.

What might be called purely accounting entry details of construction costs, have been recorded in subsidiary books of account which are variously called Plant Investment Ledgers, Construction Ledgers, Investments in Plant and Property, etc. Prior to the inauguration of public regulation of Electric Utilities in about 1907, the subclassifications of these ledgers were very broad and generally resulted in dividing the Fixed Capital costs among only a few general property groups. These subdivisions of accounts usually followed the three principal groupings of Land, Building and Equipment, which divisions were again subdivided by columnar development, to show the Land and Building cost at a given location and certain major divisions of the equipment, such as Equipment in Generating Stations, cable in ground, overhead lines and apparatus, meters and metering equipment, etc. Quite naturally, among the various companies, there was little or no thought of any standardized method or uniform system of keeping separate costs.

Gradually, however, as the Utilities grew in size and magnitude of details, and were faced with the demand for statistical information by the various Regulatory Commissions, the necessity for more reliable data and less guess work in the matter of costs, led most of the companies to install Cost Systems which have been variously designated as Job Order, Work Order, Authorization and Project Order Systems. The fundamental requirements fulfilled by these systems, when properly administered, were those of budgetary or financial control of construction expenditures, and the determination and recording of the historical costs of individual additions, replacements, and retirements of property. The Job Order and Work Order Records, which represent periodic property additions and removals, balance with the summary postings of labor, materials, sundries, etc., in the subsidiary controlling accounts. The earliest use of the Job Order or Work Order System, insofar as the electric business is concerned, dates back to about 1898.

While the Job Order or Work Order resulted in establishing a subaccount, its use extended beyond the purely accounting function, inasmuch as it represented the first endeavor to relate specific portions of the property to the costs thereof. History records that the advent of the Job Order and Work Order Systems were originally severely criticized as involving excessive and burdensome detail accounting. Eventually they were recognized, however, as a necessary part of Utility accounting. With the further expansion of Utilities, and the rapid changes due to additions, retirements, and replacements of Plant Property, there has been a gradual recognition of the fact that still more detail and technical accounting is required if the Plant accounts are to be maintained so that they reflect, as accurately as possible, the cost of the properties, used and useful, at any particular time.

Uniformity of Electric Plant Accounts among the different Electric Utility Companies and instructions concerning the use thereof, are gradually being obtained by the creation of Uniform Systems of Accounts. The original uniform classification of accounts issued in 1907, the later modification in 1923, and the present complete revision by the Federal Power Commission and National Association of Railroad and Utilities Commissioners have progressively required more detailed accounting of plant costs. The present requirements necessitate not only careful study on the part of the Accountant to re-educate himself in terms of phraseology and methods but also require substantial cooperation on the part of the Engineer to whom the Accountant must look for factual information concerning physical changes in the property.

Units of Property

As early as 1922, pioneer studies and developments were started in various companies under the characterization of property records, perpetual inventories, or fixed capital records. Basically, these developments attempted to determine so-called units of property, which units were related to their actual cost. When the unit was replaced, the old unit would be retired and the new unit would be entered in a record maintained independently of the general Plant Accounting structure.

From that time until the present, there has been considerable argument and debate over what constitutes a unit of property. During the past three years, some of the State Commissions have made mandatory a System of Continuing Property Records, but as yet there has been no substantial national progress toward determining the scope and limits of a unit of property. At the present time, there are two schools of thought; one believes that the units should be very large in order to avoid excessive accounting and detail of records, and the other, that they should be very small in order that the Plant Accounts may be maintained with a high degree of accuracy. There still exists great confusion as to the meaning of the term, unit of property.

This confusion is partially responsible for the present differences of opinion in respect to large units and small units. In order to clarify this situation, it is proposed to explain the various uses of the term "unit," and their possible application to the Primary Plant Accounts, Subaccounts, Job Orders, Continuing Property Records, Retirements, Plant Inventory, and Plant Inventory Measurement. Conceivably, the entire plant and property of a Public Utility may be regarded as a unit of property, the cost of which is reflected by the Balance Sheet Account "Electric Plant." It is also true that the subdivisions of the "Electric Plant" Account which are called Primary Accounts and are prescribed in the Uniform Systems, are in a broad sense units of property. Likewise, any subaccounts of these Primary Accounts, used for Company purposes, can be construed as units of property. It is also true that a Work Order or Job Order account, inasmuch as it reflects, on completion, the cost of a segregation of the property, constitutes in a sense a unit of property. Up to this point, these segregations of property which may be called units, represent definite accounting divisions in the general plant accounting system.

In a Continuing Property Record System, we have the following considerations, in connection with explaining the possible use of the term "units." The primary controls of the Continuing Property Record System are customarily the Primary Accounts and Subaccounts of the general Plant accounting system. Beyond that point, subcontrols are used, usually called "Cost Classifications." These cost classifications do not represent accounts but are useful for summarization and index purposes.

The minimum division of the property underlying the cost classification, which is selected to be continuously associated with its cost in the property record system, may be defined as the *"Continuing Property Record Unit."*

The principal component parts of a Continuing Property Record Unit which are worthy of separate itemization in the Record, the cost of which is not required to be recorded separately in the record system, may be defined as *"Plant Inven-*

tory Units." The quantitative measurement of the Plant Inventory Units may be defined as the *"Inventory Measurement Unit."*

Those items of Electric Plant which, when removed or abandoned, with or without replacement, are accounted for by crediting the book cost thereof to the Electric Plant Account in which they are included, may be defined as the *"Retirement Unit."*

Frequently, in practice, some of the above units may be identical. For example, a section of cable between two manholes may be the Continuing Property Record Unit, the Plant Inventory Unit, and also the Retirement Unit. However, in such cases as boiler plant equipment, there is ordinarily no sound reason for subdividing or apportioning the cost of the Continuing Property Record Unit between the several related Plant Inventory Units of which it is composed. A boiler or battery of boilers may be a reasonable Continuing Property Record Unit, whereas each boiler, setting, water wall, etc., may be a reasonable requirement of a Plant Inventory Unit. It is to be noted that the Plant Inventory Units may quite generally constitute reasonable Retirement Units. The following examples, however, indicate their separate application in respect to certain classes of property.

Piping

Continuing Property Record Unit
All piping of one size and kind at a location.

Plant Inventory Unit
A functional system of piping; by size and kind of pipe.

Inventory Measurement Unit
Foot.

Retirement Unit
A separate section, or run of piping.

Structures

Continuing Property Record Unit
A complete structure.

Plant Inventory Unit
Steel work.
Masonry.
Plumbing.
Etc.

Inventory Measurement Unit
Pound (steel work).
Cubic foot (masonry).

Retirement Unit
Roof.
Wall.
Fixture.
Etc.

A very important operation in establishing a Continuing Property Record System is the determination of the limits of these various units.

The accounting costs of doing the work will be excessive if the Continuing Property Record Units selected are too small in scope. Likewise, if the Plant Inventory Units are too small, the Field Inventory costs will be excessive. Further, if the Retirement Unit is also too small, the accounting costs again will be excessive due to the additional accounting detail required. There will also result a distortion of the costs between those which are normally considered to be chargeable to repairs or maintenance and the charges to the depreciation reserve for property losses.

In comparing the relative advantages of large and small units, however, special consideration must be given to the units of property which are finally selected for certain types of property. It would appear that where there is a rapid turnover of the property as in the case of underground cable, the selection of a small unit may permit the most economical maintenance of the Continuing Property Record. It can be readily seen from the foregoing that these various units must be selected with care and discretion, not only to permit the operation of the Continuing Property Record on a sound economic basis but also to establish, as nearly as possible, the correct dividing line between capital and maintenance charges. Again it seems that one of the Engineer's responsibilities is to understand the fundamental accounting principles in order to help in the selection and establishment of the most appropriate units of property.

Installation of a Continuing Property Record System

The exact procedure to be followed in the installation of a Continuing Property Record System, and the best way to organize the work will vary according to the circumstances and practices encountered in the particular company and it is hardly possible, and entirely impractical to formulate any rule or rules that would be suitable to all companies.

It will be found at the outset that in most companies cost records for various kinds of physical properties have been maintained, in more or less complete form, in different departments for their own individual purposes. The Operating and Engineering Departments, for instance, have their records of line transformers and devices, meters, overhead and underground lines, etc., showing location, quantities, sizes and other information necessary for a complete property record, except perhaps detailed costs. Similarly, the Power Plant and Substation Departments maintain records of the main items of equipment under their jurisdiction. Also, the Statistical Divisions will undoubtedly have their records showing summaries of property of various kinds, and the Accounting Department has records showing property investments in more or less detail. This may likewise be found true in other departments.

It is the purpose of the Continuing Property Record work to centralize all this information and keep complete overall records with detailed related costs in complete form. As the functioning of the system becomes more and more comprehensive, departmental records should be eliminated and the necessary information, when needed, obtained from the centralized records. Certain departmental records must, however, be maintained on account of the heavy continued use made of them in connection with operations.

The first step toward the establishment of basic Continuing Property Records in an operating company, after a general determination of the scope of the various units and cost classifications, is the preparation of a physical inventory of the property or the adoption of an existing inventory already prepared and corrected to date. Such an inventory should include a count of all property units or items properly chargeable to the Plant Accounts, classified in accordance with the Uniform System of Accounts.

The next step is to make a complete analysis of the Fixed Capital Accounts insofar as it may be necessary or practical, for the purpose of associating each Continuing Property Record Unit of the inventory with its original cost, where available, or cost as determined by using relative values and a consideration of past experience in similar work. At the outset a statement of the book costs by accounts would be required for the purpose of establishing a working control. A supplementary statement of work in progress showing the Job Orders or contracts, and the bookings to date, should be prepared to identify that portion of the physical inventory at the time of initiation which applies to unfinished construction.

In connection with cost finding, the application of the book costs to the inventory may be summarized as follows:

(1) Classify the book costs as nearly as possible in accordance with broad cost classifications of the property.

(2) Compare the physical inventory with

details of the classified book costs for the purpose of establishing the reasonableness of the overall book balance.

(3) Relate the segregated original costs with the corresponding physical groups wherever possible, and where not practical, determine or estimate probable original unit costs and apply them to the physical quantities of the inventory, in this way distributing the book costs over the physical inventory.

An important feature of Continuing Property Records is the forms that are used, in general following two types; namely, tabular forms and card forms. The tabular or loose leaf book form is more adaptable for recording the details of the physical properties and the costs of Inside Plant properties, such as power stations, substations, and general structures. On the other hand, where there is a frequent turnover and a high degree of flexibility is required, the card form is in general use.

In setting up a Continuing Property Record for Outside plant two general plans are in common use. The first is frequently referred to as the "Specific Cost Method" and the second is the "Average or Area Cost Method."

The "Specific Cost Method" is a method whereby the job cost is assigned to the unit or units installed on that job and thereafter this cost remains associated with each unit until retired.

The "Average or Area Cost Method" is a method whereby average costs for a year of a group of similar items is determined for an area such as a map area. When one of these units is retired the average unit cost for that year for that particular area or group is used for retirement purposes.

In the preparation of a Continuing Property Record an inventory must be prepared either from field measurements or from office maps and records. The inventory facts concerning each unit should be recorded separately. For example, the Overhead Services Inventory should show the year of installation, size of wire, number of wires, total footage and other pertinent information.

The next step would be to determine the actual cost per foot for installing Overhead Service Wire by size, by year of installation.

If the "Specific Cost Method" is selected each Overhead Service would be separately priced according to the year of installation and the amount and size of wire. This cost would thereafter be associated with that service, until its retirement.

If the "Average or Area Cost Method" is selected all Overhead Services within an area are summarized by size, length and year of installation to determine the total feet of wire by years of installation. These totals would be priced at the average yearly developed cost in order to determine the total investment by years of installation. Additions are added to the area summaries according to size and year of installation. In making retirements, the length, size and year of installation of wire should be known so that it can be priced at the average yearly installation cost.

Property with frequent turnover such as in the Electric Distribution System, the "Specific Method" of pricing is more flexible and is better adapted for effecting additions, retirements, and compilation of statistics than is the "Average or Area Cost Method." The latter method has a useful application for certain properties dealing with similar kinds of units but where the turnover is infrequent.

The Continuing Property Records for Inside Plant property, that is, Structures, Mechanical and Electric Station Equipment, have in general been established on the "Specific Cost" base because of the many dissimilar units and groups of units making up the various operating installations.

The Engineer's and the Accountant's Jobs

The Engineer's Job and the Accountant's Job, in respect to establishing and maintaining Continuing Property Records, may be summarized as follows:

Engineer's Job

1. To cooperate with the Accountant in the determination of the types of record to be installed, the subclassifications to be established, and the scope of the units to be used.
2. To carefully review existing operating records and determine the extent to which they can be utilized in the preparation of the basic inventory.
3. To plan and supervise the preparation of any field inventories, required for the basic records.
4. To assist the Accountant in the apportionment of the costs applicable to the Continuing Property Record units, where such costs are not available from the analyses of Work Orders or accounts.
5. To establish a practicable and economical means of providing the Accountant currently with accurate records of the additions and retirements of plant, arranged and classified in the same manner as the basic records.
6. To acquaint the various operating departments which are involved with the requirements of the Continuing Property Records and assist the field forces in the proper allocation of costs to Work Orders.

Accountant's Job

1. To cooperate with the Engineer in the determination of the type of record to be installed, the subclassifications to be established, and the scope of units to be used.
2. To prepare the necessary cost analysis of the Electric Plant Accounts for the pricing of the basic inventories.
3. To determine as far as possible the purchase costs of the Continuing Property Record Units and in the case of the larger Units, their cost of installation, where such information is available from Work Orders and accounts. To determine from an analysis of the books suitable unit costs for pricing the smaller and more general Units, such as General Equipment and Outside Plant Properties.
4. To cooperate with the Engineer in the apportionment of the costs to the Continuing Property Record Units where such costs are not available from the cost analysis.
5. To reconcile the priced basic inventories with the Plant accounts and make the necessary book adjustments to bring the two into balance.
6. To establish the basic Property Record as a subsidiary accounting record, eliminating such existing subsidiary records as may be superseded by the record. To provide, as to whatever extent may be practicable, the utility of the records for other Company operations.
7. To analyze currently all Work Orders and Retirement Orders in connection with the current additions and retirements, to associate the costs with the field reports, to prepare the necessary debits and credits to the book accounts and to delete the units removed and add the units installed in the Continuing Property Records. To maintain the Continuing Property Record in balance with the books.

The Dollar Follows the Property Unit

There have been, in the past, possibly two schools of thought in respect to the capitalization of some elements of Construction Cost. Usually, the Engineer takes the viewpoint that if he installs additional capacity in a given operating station, all the costs in connection with adding the additional capacity may be properly considered chargeable to the Plant Accounts. The present trend in this connection, however, and the better accounting practice appears to be that any costs incurred in connection with the adding of physical property to a given plant, made necessary on account of operating the plant during the construction period and which costs would not be involved if a new plant were erected, should either be charged to an appropriate operating expense account or amortized over a reasonably short period. To illustrate this, I will take a specific example:

X Company enlarges a Power Plant Building for the purpose of installing a new turbo-generator that will increase the plant's capacity by 50,000 kw at a very low increment cost. The construction work involves: (1) Tearing down the end wall of the building. (2) Extending the side walls and building a new end wall. (3) The abandonment of an old ash pit. (4) The construction of a

(*Continued on page* 181)

Electrical Achievements from Creative Ability

By M. O. Troy

Commercial Vice-President, General Electric Company

From the *Virginia Engineering Magazine*, by permission

WHEN you enter your home at night and press a button, you know that you will receive light. The common assumption is that somewhere or other a vast reservoir of electric energy is stored up awaiting your demand and that you merely have to press a button to take your small part of this vast store. This is a fallacy. The electric energy which is supplied you when you press the button was not in existence the instant before. It is generated and transmitted to you at the speed of light (186,000 miles per second), after you have registered your demand. The response is so instantaneous that the householder's concept is that it must have been stored and waiting for him like the water in a reservoir that supplies his house when he opens a faucet.

The instantaneous response which the householder receives is the common everyday experience of the average American. It may sound like magic, but it is not. It is typical of the personal way in which electricity serves you and serves the nation.

Stuart Chase has said, "Power for industry and business and agriculture are all vastly important, but from a broader point of view, they take second place to the promise of power for actual human living. Here lies its transcendent role in the years before us."

Owen D. Young, with characteristic clarity, reminds us that we have spent ourselves, both brain and money, in the creation of great machines, and that we should now turn that energy and experience to building "the most important mechanism of human life—a modern American home."

The story of the electrical industry which provides this service is fascinating. Let us floodlight it for a few minutes and look at it together.

This industry had its inception with the work of the electrical inventors of the nineteenth century. Brush's invention of the arc-light machine in 1876, Edison's invention of the incandescent lamp in 1879, Stanley's invention of the transformer in 1886, are typical examples. In 1882 the first commercial electric generating station was installed. It supplied electric lights for a few buildings in New York City. From these very small beginnings of fifty years ago, the industry has grown to its present vast proportions. Now let us try to appraise it.

The Electrical Industry—1936

The Electric Service Industry—
- No. of enterprises—3500
- Investment—$13,300,000,000
- Annual gross revenue — $2,231,000,000
- Plant generating capacity—34,500,000 kw
- Annual output (1936)—108,854,000,000 kwhr
- Transmission lines and network—more than 200,000 miles
- Number of customers—26,000,000
- Territory covered — entire United States, except the most sparsely settled sections
- Homes served—
  - 87 per cent of all non-farm homes
  - 70 per cent of all homes in the United States including farms

The Electrical Manufacturing Industry:
- Number of manufacturers—1500
- Persons employed—more than 200,000
- Value of product produced annually—more than $1,000,000,000.

The electrical manufacturers included in the above not only produce equipment for generation, transmission, and distribution of electric energy, but also supply the utilization equipment and electric appliances needed in home or industry.

What has caused the electrical industry to grow to its present magnitude in a little more than fifty years since its inception? Why does the United States, with only 7 per cent of the world's population, consume more than 30 per cent of the electric energy produced in the world? Volumes have been written in answer to these questions. However, the answers may be summarized by saying that it was because this industry has had the initiative and the ingenuity to develop and adapt electricity to its many uses, thereby bringing to the average home and to commerce and industry benefits available from no other source.

In the Home

Electric service provides comfort, convenience, safety and health through the instrumentalities of good light, refrigeration, convenient cooking, pumping and heating of water, driving laundry equipment, and other manifold uses.

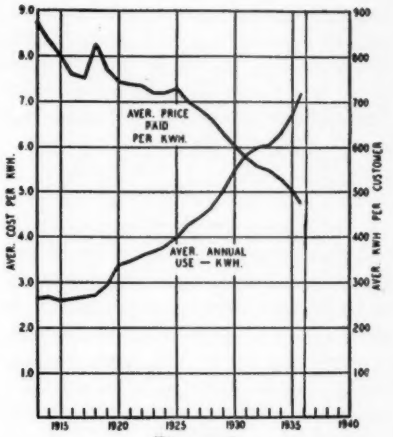


Figure 1

At what cost? An average of $35 per home per year, or less than 10 cents a day.

Electricity provides efficient, easily controlled power and effective lighting, making available to more people greater convenience and comfort at lower cost.

Fig. 1, shows how the cost of domestic electric service has decreased year after year as its use has increased. In 1882 the cost of a kilowatt hour was 25 cents. In 1936 its average cost was 4.74 cents. With reduction in costs has come a steady increase in the quality of service and in the efficiency of utilization.

For example, the 100-cp filament lamp of 1891 required 310 watts. Today the same lamp of modern design requires but 100 watts.

Many of us can recall when electric service was supplied by a single isolated electric plant which served only during the night hours. Even this service was subject to interruptions due to lightning, storms, and other causes. Today, the great majority of us receive service from large networks supplied by several plants. The supply is continuous, and interruptions or even occasional variations in voltage rarely occur.

On the Streets and Highways

Electricity provides light which adds to the safety of transportation, trade, and commerce.

The question of highway lighting is now receiving much attention as a safety measure. Bearing on this subject, I quote a statement of R. E. Toms, Chief, Division of Designs, United States Bureau of Public Roads, Washington, D. C., "Engineering ingenuity can never entirely compensate for human error and mechanical failure. *Increasing the sight distance by various means is perhaps the engineer's greatest contribution to safety.* Signs, visible both day and night, and the *lighting of short sections of highway* where traffic hazards cannot be eliminated would assist materially."

In Industry

Electricity makes more power available for each worker, enlarging his output fortyfold and resulting in greater production with less effort and at lower cost. It provides easily controlled, flexible power in a great variety of applications whether we consider the power to drive the tools, the heat for making alloys, or the light with which to see.

Period of Great Expansion 1902-1930

In the early days of the electric light and power industry, the Edison pioneers were faced with all the problems except load building. There was a market anxious to receive service as quickly as the service companies could supply it. The problem was not one of load building, but of invention, new construction, building of plants and lines to take care of customer's load to be served. The manufacturers of electric equipment were kept busy producing, working on inventions to produce electricity with fewer pounds of coal, working on schemes to transmit power longer distances and at higher voltages. And we should not overlook a major problem which faced the electric light and power companies of organizing in different cities and financing their developments. The continuous and broad expansion from 1902 to 1930 is an unparalleled record of achievement. During this time electric-service customers increased from five million to more than twenty-four million; and the annual sales of electric energy increased from 2,000,000,000 kwhr in 1902 to 75,000,000,000 kwhr in 1929.

During this period of expansion the electrical industry made great technical improvement. The service companies were continually demanding larger and better equipment and were quick to adopt new improvements produced by the manufacturer and to pass these improvements on to their customers in the form of lower rates and better service.

The electrical manufacturers were particularly resourceful in developing better ways to do things. They were among the first to recognize that great progress must be based on new scientific facts and that the way to this knowledge was through research.

One large manufacturer established a research laboratory early in 1900, which expanded steadily so that in 1920 its annual expenditures exceeded a million dollars. From this laboratory came such developments as the modern incandescent lamp, vast improvements in steam turbines, the development of low-loss silicon steel, improvement in high-voltage transmission and lightning protection, many forms of the modern vacuum tube, and other outstanding achievements.

Other manufacturers became active in the establishment of research facilities tending to promote engineering development and accomplishment. Through this unremitting engineering research and the wise application of products, the electrical industry achieved the high degree of progress which has made America the acknowledged leader of the world in electricity.

Many engineers and scientists were required to develop the equipment and to meet the growing demands of the service companies. Hundreds of millions of dollars were spent annually by the electric-service companies for new construction, for application engineering, and in the employment of men and materials to build and operate the vast systems which came into being.

1930 Brings a New Era

In 1930 the situation changed; we entered a depression period. We found ourselves faced with a new problem; factories slowed down; incomes were reduced, hindering the full use of domestic lighting and appliances. The electric-service industry found itself geared to sell more than 75,000,000,000 kwhr annually, but it was selling less than in 1929.

The decline continued in 1932 and '33. Notwithstanding all this, the depression proved that the electrical industry was one of the most stable of all industries. However, there was little need for additional generating stations or distribution or transmission facilities. Construction departments were curtailed or abandoned. In many instances, their engineers were without work. Likewise there was little demand upon the manufacturers for electric equipment, or for engineers and other workers to design and produce it.

The attention of both service companies and manufacturers was shifted by the depression from system extensions to load building.

Load Building 1930-1937

The responsibility for a proper return on an investment of twelve billion dollars was felt keenly by the electric-service companies as the load and revenue became less. New sources of revenue had to be found. It was recognized that loads did not automatically grow; they had to be created by one motive or another. A tremendous amount of money, effort, skill, manpower, and salesmanship is required to create load on a large scale. The manufacturers were greatly interested that the service companies should continue to grow. Therefore, the manufacturers with their vast selling organizations, research laboratories, and experienced engineers cooperated with the service companies by making available improved designs of old established load builders and brought into existence new developments to broaden the use of electricity.

The electric-service companies expanded their sales departments, adding men to sell load builders, small and large, and appliances of every description. Intensive campaigns were inaugurated to sell refrigerators, ranges, and water heaters in the home. The "Better Light-Better Sight" campaigns showed what a great price the public was paying in health because of inadequate lighting in our homes, schools, and offices. The idea of the "All-Electric Kitchen" and the "All American Home" followed closely, thus greatly increasing the potential market for electric service in the home.

What was the result of all of this load-building activity? By June of 1935, the electrical output had returned to its 1929 level. Since then it has continued to increase until in 1936 it exceeded 1932, the low year of the depression, by 40 per cent, and exceeded the 1929 output by 20 per cent; all of this notwithstanding the fact that the industrial and business activity of the country has not yet returned to the level of 1929.

This comparison shows unmistakably that through its initiative and skill the electrical industry has pulled itself out of the depression before industry, in general, had returned to normal. The gain in electric output during 1936 was 15 per cent, and now, in 1937, load building is continuing to grow at an even faster

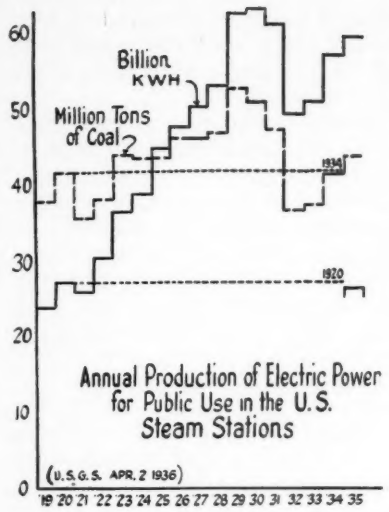


Figure 2

rate. Such a phenomenal growth in load before we have fully emerged from the depression means expansion of power systems and facilities, and the purchase of equipment. Construction and engineering organizations must be rebuilt; and manufacturers will receive large orders for equipment required in generation, transmission, and distribution.

It is a noteworthy fact, however, that in many instances the equipment furnished in 1937 and 1938 will not be the same as that furnished before the depression. It will be of new and greatly improved design. It will be more efficient and dependable than that which was heretofore available.

During the depression the leading electrical manufacturers continued their research and engineering developments. The results of these efforts make available to the service companies improved equipment which will produce more power at lower cost. I believe you will be interested in a few examples of this type of scientific pioneering. In power generation, the engineering objective has been to produce more energy from each unit of fuel, in electric power transmission and distribution to reduce the losses, and in electric power utilization to make each kilowatt hour do more or go further.

Fig. 2, which gives the annual production by fuel of electric power for public use in the United States, shows that in the year 1920, twenty-seven billion kilowatt hours were produced with forty-one million tons of coal (or its equivalent in other fuels), while in 1934 fifty-seven billion kilowatt hours were produced. The coal consumption was just the same, forty-one million tons, so that we have been able through engineering to give the public more than twice the electric power without increasing the fuel consumption, a notable achievement in the conservation of fuel resources.

Fig. 3 shows the improvement in fuel consumption of electric power stations year by year, the performance of the best stations, and the still further improvement possible with the perfection of the mercury steam station. Were it possible to have all fuel-burning stations equal to the best, we should in 1934 have been using but twenty-six million tons of fuel to produce fifty-seven billion kilowatt hours.

It is also interesting to note that what represented the best in 1920 became the average of 1934. If history repeats itself, and during another fifteen-year cycle

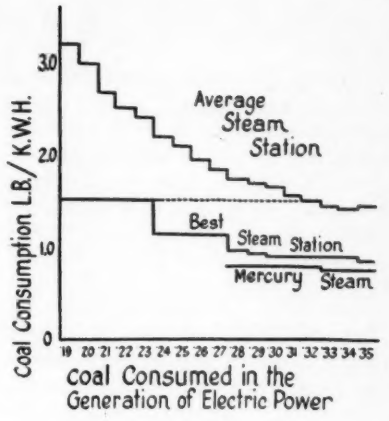


Figure 3

the best of 1934 becomes the average of 1949, we may expect to see the average of the country's production to be a kilowatt hour at considerably less than one pound of coal.

One of the outstanding ways in which the electrical industry has been "getting more for less" is in the super-position of high-pressure, back-pressure turbines in existing steam plants. These turbines admit high-pressure, high-temperature steam, develop a certain number of kilowatts, and discharge the steam from their exhausts into the present steam headers of the low-pressure stations. In this way, it is possible to increase the capacity of present stations from 40 per cent to 90 per cent, depending on the conditions.

Where old plants are modernized in this way, it is sometimes possible to obtain this additional capacity with little or no increase in fuel consumption. This is due to the more efficient boilers used, as well as the more economical heat cycle,

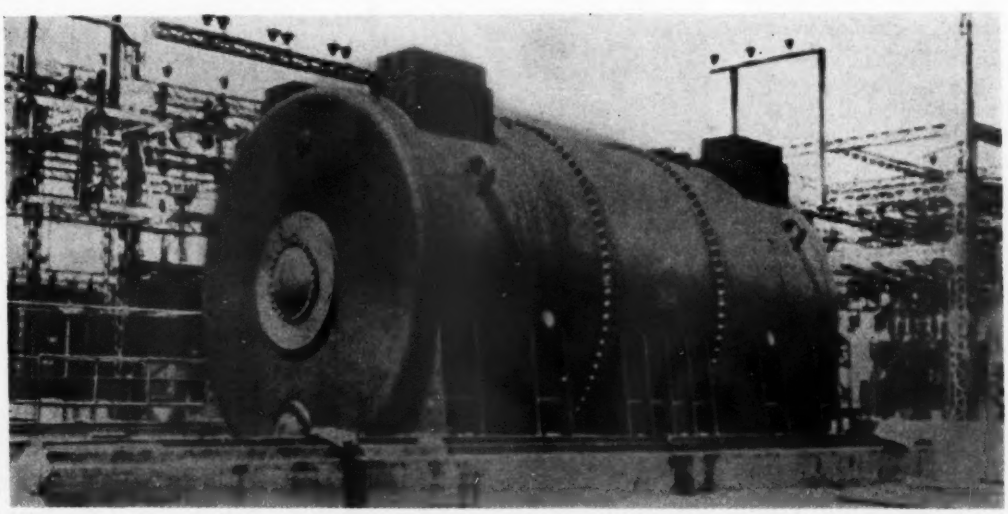


Figure 4—A 60,000 kva Synchronous Condenser

eliminating much of the energy loss in the old plants.

An outstanding example of the value of engineering research in effecting a more economical use of construction materials, and greater economy of machine operation, is the development of hydrogen cooling as applied to rotating electric machines. For years practically all classes of rotating electric machinery were cooled with air, chiefly because it was more convenient to use air than anything else. Then research showed that this practice was wasteful—that there were gases other than air in which machines would operate more efficiently and with a greater output per pound of material. Chief among these gases was hydrogen. This gas has a density only one-fourteenth that of air, so that the windage friction and ventilation losses of a rotating machine would be reduced to one-fourteenth of their value in air by operation in hydrogen. Also the thermal properties of hydrogen are distinctly superior to those of air, so that by operation in hydrogen instead of air, up to 25 per cent greater output may be obtained from a machine of given physical dimensions for the same temperature rise of the parts.

The first applications of hydrogen cooling to rotating machines were to synchronous condensers and frequency changers; and so successful have been these applications that in the last eight years seventeen hydrogen-cooled machines of these types, having a combined capacity of nearly one-half million kva, have been placed in service.

Fig. 4 shows the installation of a 60,000 kva hydrogen-cooled synchronous condenser. In addition to this improved economy, it provides the benefits of outdoor installation and the savings incident to buildings.

An even greater economic gain is realized in the application of hydrogen cooling in high-speed turbine generators. With this class of machines the windage friction and ventilation losses with air cooling comprise about one-half the full-load losses; hence the use of hydrogen reduces the total losses by nearly one-half, corresponding to a gain of about 1 per cent in efficiency.

Fig. 5 shows the efficiency curves for two turbine generators, each of 50,000 kw capacity at 3600 rpm, the one designed for air cooling; the other, for hydrogen cooling. It will be observed that the gain in efficiency by the use of hydrogen cooling ranges from 1 per cent at full load to nearly 4 per cent at one-fourth load.

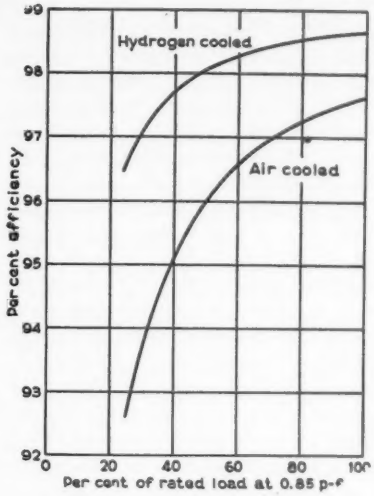


Figure 5

Fig. 6 shows the installation of one type of hydrogen-cooled turbine generator. The volume of active material in such a machine is about 20 per cent less than would be required for an air-cooled machine of equal rating.

The marked and continued improvement of transformer efficiency has played an important part in reducing the distribution losses. Since 1920 the losses of distribution transformers have been reduced an average of 20 per cent.

Fig. 7 shows that the average full-load losses of power transformers have been reduced 45 per cent while the core losses have been reduced 62 per cent during the same period.

A few illustrations of advances made in transmission equipment will be of interest. A comparison of the conventional tank-type and the modern impulse-type high-voltage oil circuit breaker for 287,000 volts indicates that the interrupting time has been reduced from eight cycles to three cycles, the weight from 294,000 lb. to 113,000 lb., and the oil from 23,700 gal. to 2300 gal. Similar advances have been made in low-voltage, low-interrupting-capacity breakers, so that today a 50,000-kva, 15,000-volt oil circuit breaker weighs less than one-half as much as the breaker available a few years ago, and has less than one-half the oil contents.

As an example of the advance made in the appliance field, there are in service today approximately 10,000,000 household refrigerators. Today three electric refrigerators operate with the same electric power consumption as one required in 1926; and the user may purchase a much superior unit for less than one-half the amount he paid in 1926. Great advances have been made in improving the appearance of refrigerators and all other household devices.

Accomplishments such as these are bound to aid the progress of the industry and the country. An industry with such

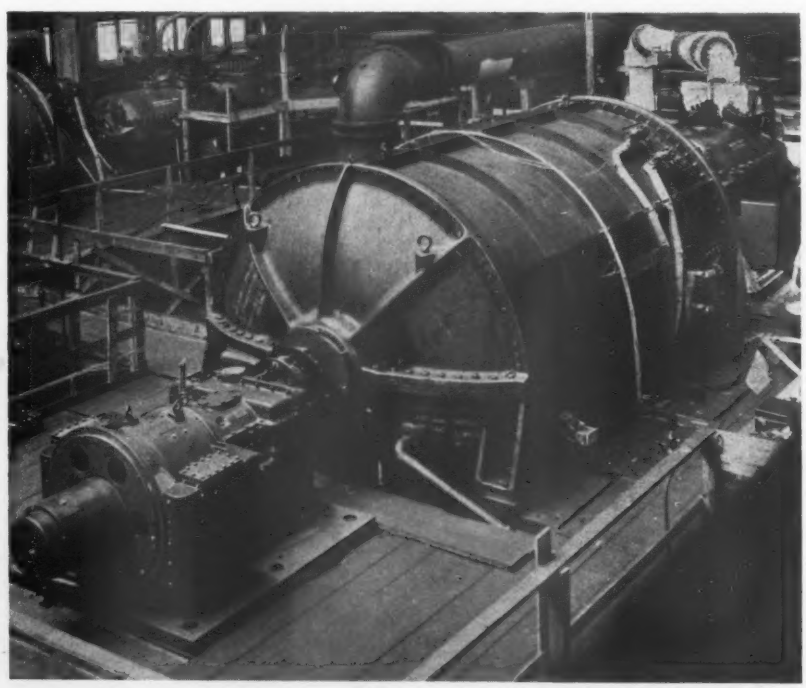


Figure 6—Typical Large Size Hydrogen Cooled Generator Set (Without Lagging) Under Test

a spirit of progress is sure to go far. What will be its future? No one can say. Predictions have been made that the electric output will double in the next ten years. We do know that new uses for electric service and new improvements in equipment will continue to spring from the work of our scientists and engineers, and upon these foundations the industry will advance far beyond our present horizons.

I hope that I have conveyed to you some appreciation of what the electrical industry has accomplished. At the same time I hope what I have said will serve as an antidote for complacency. Much remains to be done. Future progress, as in the past, depends directly upon hard work, new ideas, and initiative. Achievements are the result of ideas put to work.

Think of the work to be done if the electrical industry doubles in the next ten years. Think of the research workers, engineers, technically trained factory men, accountants, draftsmen, and others needed by the manufacturers, and the planning, construction, and operating engineers, salesmen, accountants, and others needed by the electric-service companies to handle this new business.

What does this mean for the technical graduates of our colleges, those who are destined to be the future technicians of this great industry? It means opportunities not unfolded to the early pioneers, but it also means that these men must be endowed with technical skill and creative ability to carry on the work left to them as a heritage by the workers of the past.

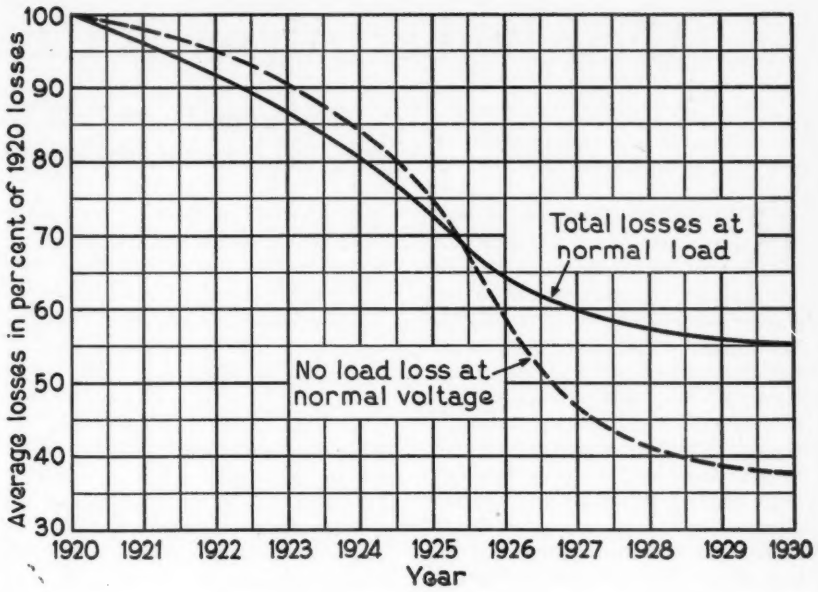


Figure 7

In the first fifty years of its growth the electrical industry has not reached maturity; it has far to go and what lies ahead for the technical worker in this field of opportunity can best be envisioned by quoting Dr. W. R. Whitney:

"I would not dare to say what I think electricity may do in the future. We are always making the mistake of supposing we have exhausted our knowledge in any direction. Discoveries and inventions are not terminals. They are fresh starting points from which we can soar to new knowledge."

The Engineer's Interest in Unitized Plant Accounting

(*Continued from page* 176)

temporary ash pit. (5) The temporary handling of ashes, and (6) The construction of a new permanent ash pit.

What accounting disposition and why?

In the solution of this problem, we will find many conflicting views. There is little doubt at the present time we would all agree that the old ash pit should be retired although even here some would argue that because of the economic savings in installing the new unit, the cost should be considered as part of the contingent cost of installing the new turbo-generator. There, of course, would be no question involved in agreeing to capitalize the new ash pit. But, should the new ash pit of the complete new installation also carry the cost of the temporary ash pit, or, should it be charged to operations?

The correct answer to this is fairly easy if we follow the general present-day viewpoint, that the dollars must follow the property. Since in this case the property no longer exists, the cost should be charged to Production Operations over the shortest reasonable period.

The Engineer has a definite interest in this type of accounting problems for the reason that without correct factual reports the correct accounting would certainly not be carried out, thus creating a tendency to gradually pyramid and inflate the cost of the plant.

Conclusion

It is not the purpose of this article to sell what may be called "Unitized Continuing Property Records." Apparently, they are already sold to the extent that they are part of the mandatory requirements of some Commissions. Also the new uniform systems require such rigid and detail practice in accounting for additions and retirements of Plant, that the only practical means of adhering thereto is to maintain and operate such records in substantial detail.

The difficulty is that many of those who are sold to the need have little or no conception of just what they are after and what the specifications should be.

Inasmuch as there is almost no limit to the degree of detail that is possible in the record work, how far to go in the determination of units is probably the most important problem confronting those who find it necessary to install the records.

I am sure the Accountant is most happy to share, wholeheartedly, the solution of this problem with the Engineer.

Those who have recently or will become interested in this work should be warned, in the interest of economy, however, to avoid becoming over enthusiastic about extreme detail. Experience indicates that the novice in the work is apt to lose the proper perspective in the thirst for mechanical and logical accuracy.

Why Bother About Air Conditioning?

By Anson D. Marston
Kansas City Power and Light Company

RECENTLY a number of executives were asked to express their opinions about air conditioning. Through their answers runs the thought that air conditioning as an industry has "grown up." Yesterday we of the utilities paused, predicted great things in the future for air conditioning, and then passed on to more pressing problems. Today this infant has "grown up." Whether we like it or not, this new industry is here—to stay. What are we going to do about it?

That this industry is destined to be of major importance to us, no man can gainsay. A recent survey covering the territory served by fifty-one utilities shows a total of more than 410,000 hp. in air-conditioning equipment. For the country as a whole this total is probably closer to 600,000 hp.—big business in any league. These totals are increasing by leaps and bounds, and studies of possible future loads run into astronomical figures.

What are these new loads doing to our load structures? To our distribution systems? To our rate structures? What effect will they have in the future? These are questions which demand an answer. They are important questions, and their answers deserve an amount of consideration commensurate with this importance. Already many of our bigger companies are giving them extensive consideration, and the time has come when every utility needs to start doing so.

An example of the part air conditioning is beginning to play in system loads is furnished by the case of one Middle-West utility. During 1936 this utility had a peak load of 107,000 kw. (This is exclusive of the street railways load, which is served by a separate 25 cycle plant.) This peak occurred in February. During the summer months the peak load was 97,000 kw—at a time when the connected load of air conditioning customers was about 9000 hp. This question of peak loads is aggravated by the fact that the power factor of the winter peaks is around 89 per cent to 90 per cent, while that of the summer peaks is near 82 per cent. On this basis, the winter peak is 119,500 kv-a, while the summer peak is 118,300 kv-a. In view of the higher condensing water temperatures and ambient temperatures in the summer, the load on the turbines, cables, and transformers is at least equal to that in the winter.

Recently a survey was made of the territory served by this company, in an effort to estimate the air conditioning load which will be added to its lines in the next 10 or 15 years. This survey indicates the probable addition during this period of about 64,000 hp in air conditioning equipment. There is every indication that in a short time this company will experience a decided summer peak—a radical departure indeed from past conditions! In addition to its other implications, a change of this nature will cause a sweeping change in a rate structure whose "On Peak" clauses are all based on a peak occuring in late afternoon on winter days.

This example is cited because it is typical of the conditions confronting many of our utilities. Some companies are active in promoting air conditioning; in general these companies realize its possibilities and are studying its effect on their systems. Others have devoted little effort to its promotion and have few data available for such a study. Whether a utility be large or small, the questions involved are important enough to merit careful consideration.

A study of this nature may be as elaborate or as simple as conditions warrant, but certainly one essential is an accurate record of existing installations. This record may be kept in a variety of forms; essential features are:

1. Name, address, and class of business.
2. Size of installation, in tons of refrigeration, motor horsepower, or demand in kilowatts.
3. Date of installation.

Additional features which may be added if desired include: make of equipment, building data, occupancy data, type of installation, rate classification, and itemized lists of the equipment installed. Fig. 1 shows the two sides of a card used by one utility in keeping these records; many of the spaces are used only in the case of a few important installations.

The Air Conditioning Subcommittee is taking steps to gather statistics for the benefit of the entire industry. Certainly the records to be kept should be in a shape that will permit furnishing statistics in the form desired by this committee.

In addition to lists of installations it is desirable to keep some record of the energy consumption by air conditioning customers. In many cases this is a difficult undertaking, because the air conditioning equipment is tied in with other equipment in such a manner as to make segregation difficult. Usually, however, it will be found that data can be collected on enough installations to give a reasonable accurate idea of the total energy usage.

Lists of prospects are of value also. These may be compiled in a variety of ways. Usually where the utility is active in promoting air conditioning one will be already in use. Where this is not the case, if it is desired to estimate the extent of new load that can be expected it will be necessary to prepare one.

How are all these lists to be compiled? The list of existing installations may require a special survey if no record has been kept in the past. Usually the air conditioning dealers will be glad to cooperate by furnishing information about installations which they have made in the past. Once an installation list has been brought up to date it is relatively easy to keep it so, with the help of friendly dealers plus records of customers' requests for service. Many companies issue installation lists at regular intervals; dealers find these lists so valuable that they are glad to cooperate in keeping them correct.

Surely when the work involved in keeping these records is compared to their importance the conclusion will be reached that they are worth keeping! After all, this thing called air conditioning threatens to pull our preconceived notions of load distribution and rate structures around our ears. We cannot afford to be in the dark as we study its effects!

Some recent studies undertaken by the Kansas City Power & Light Company furnish an example of the uses which can be made of air conditioning records. For the last three years this company has prepared lists of the air conditioning installations in its territory. The list prepared

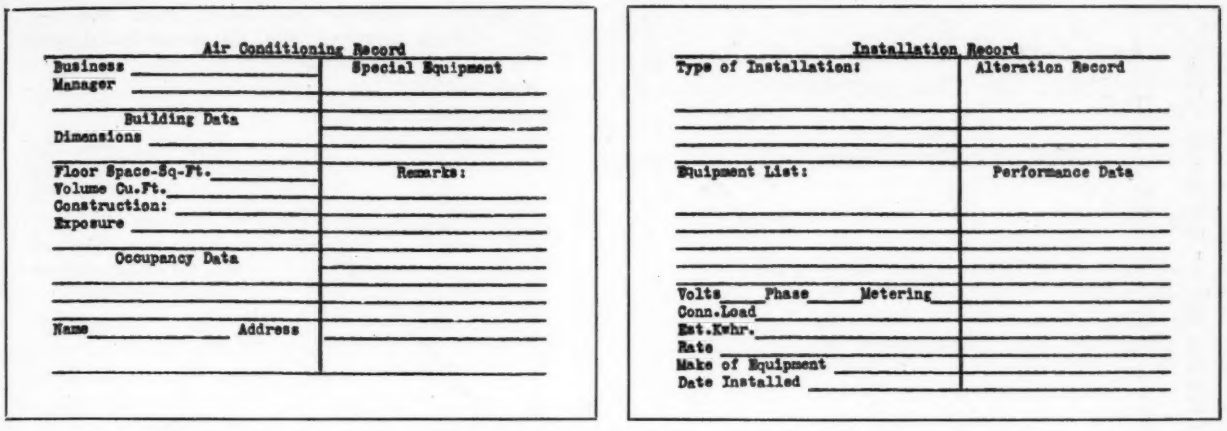


Figure 1—Both sides of a card used by a utility company in keeping customer's air conditioning records

at the end of 1936 shows a total of 9885 hp, divided as follows:

Department stores	466	hp
Misc. retail stores	959	"
Offices	1,162	"
Public buildings	2,680	"
Hotels	698	"
Dairies and ice cream	7½	"
Restaurants, etc.	967	"
Hospitals	61½	"
Theaters	1,870	"
Misc. commercial	496	"
Residential	518	"
Total	9,885	hp

The task of determining the amount of energy consumed by these air conditioning customers is a difficult one. In most cases the meter serving the air conditioning equipment measures also the energy consumed by other equipment. For example, all residential installations of 3 hp or less are added in with lights, refrigerators, and other appliances.

Fortunately a number of these customers are served on a special air conditioning rate. This rate, which was offered first in 1933, provides that the air conditioning equipment shall be served by a separate meter; this meter is disconnected on October 15 each year, and re-connected on May 1. As this is an *optional* rate, only 72 customers have used it long enough to furnish records of value in this study. Many of these furnish records covering a part only of the period 1934 to 1936 inclusive, but enough information is available for each of these years to serve as a basis for close study of the energy consumption during these years.

Table I shows a summary of the records obtained from these customers. A study of this table will show that a wide variation exists from year to year. For example, the energy consumption of commercial customers varies from 1127 kwhr per horsepower in 1934 to 814 in 1935 and 1109 in 1936. Obviously there is a difference in summers which complicates the effort to forecast the revenue to be expected over a period of years from a group of air conditioning customers.

For a number of years the heating industry has used the figure for "Degree Days Below 65° F" as a basis for similar estimates of heating requirements. These figures are used throughout the country, and they give satisfactory results.

Up to the present time no similar basis for estimating cooling costs has been devised. A few scattered studies have been made in an effort to determine such a basis, but in general these have been unsuccessful. For one thing, few data are available showing energy consumption for air conditioning systems prior to 1934.

From a theoretical point of view it might appear at a glance that no satisfactory common denominator for cooling costs can be found. The calculations of heating loads are fairly simple, and involve primarily two factors only:

1. Heat transmitted through walls, roof, floor, etc.
2. Heat loss due to infiltration of outside air.

It will be noticed that for a given building the heating load depends very largely upon outside conditions—i.e., weather factors.

The calculations necessary in determining the cooling load must take into consideration several additional items, which are largely independent of weather conditions. The calculations of *cooling loads* are usually divided into five items. These are:

1. Heat transmitted through walls, roof, glass, etc.
2. Heat resulting from the direct effect of sun light.
3. Heat and moisture from infiltration and other outside air.
4. Heat and moisture due to the presence of human beings.
5. Heat load from special equipment—motors, lights, appliances, etc.

A study of this list will show that the first three items depend upon outside

TABLE I—ELECTRICAL ENERGY CONSUMPTION
AIR CONDITIONING CUSTOMERS
KANSAS CITY POWER & LIGHT COMPANY
Summary

	1934		*1935*			*1936*		
	Average of kwhr per hp		*Average of kwhr per hp*			*Average of kwhr per hp*		
Month	*All Cust's*	*Comm'l Cust's*	*All Cust's*	*Res. Cust's*	*Comm'l Cust's*	*All Cust's*	*Res. Cust's*	*Comm'l Cust's*
May	156	184	18	0	23	72	14	101
June	250	265	109	71	119	185	125	211
July	313	314	307	270	318	294	260	311
August	250	253	234	208	242	286	243	307
September	78	80	78	47	88	138	96	158
October	29	31	19	3	24	15	1	21
Totals	1,076	1,127	765	599	814	990	739	1,109

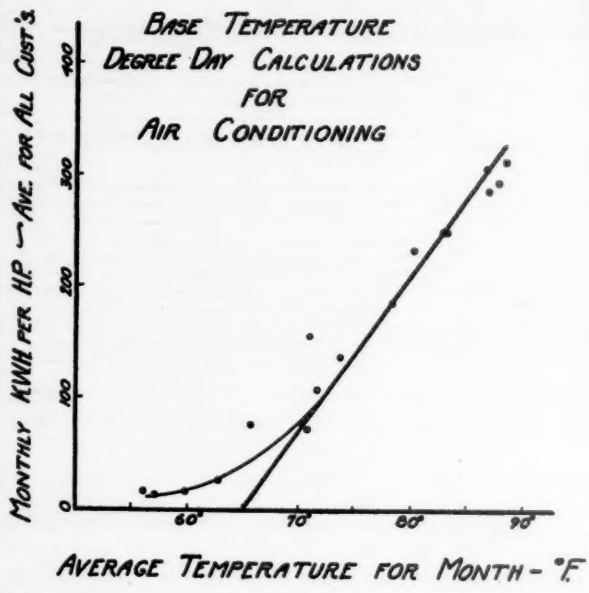


Figure 2

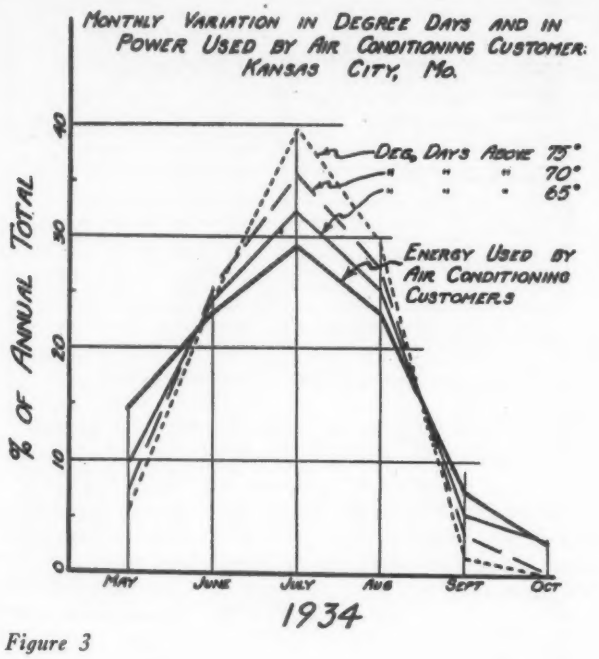


Figure 3

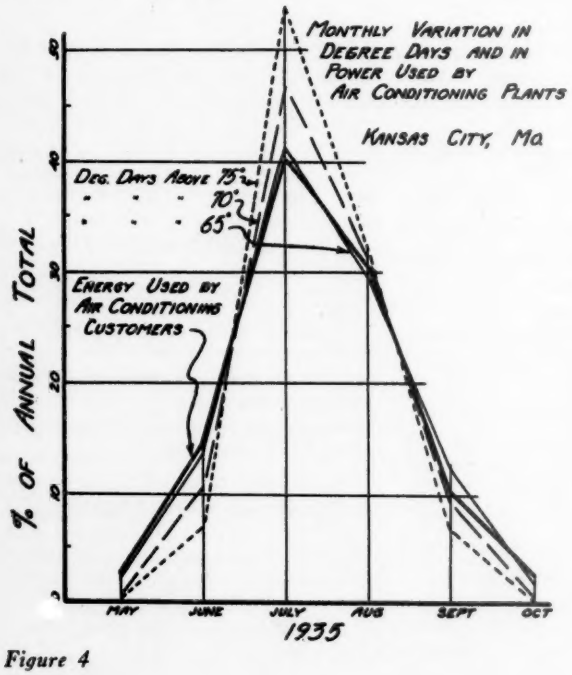


Figure 4

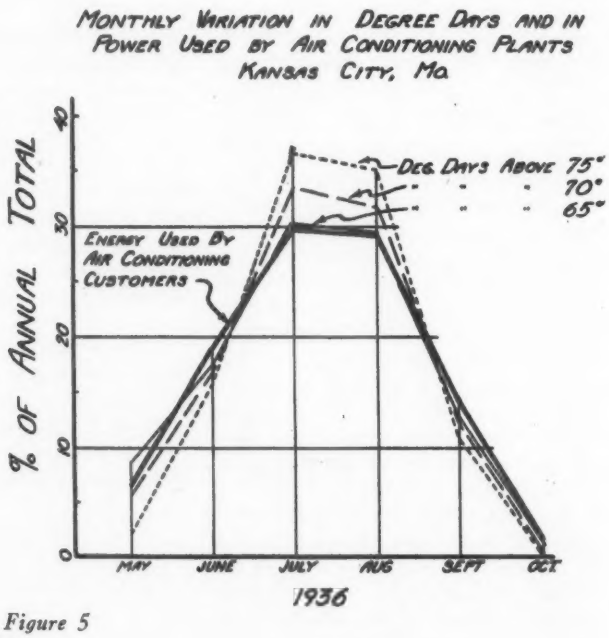


Figure 5

weather conditions, although Item 2 is not covered in normal weather bureau reports. The other two items are entirely independent of outside conditions, and frequently constitute a major portion of the load.

In spite of the variety of items involved it will be shown that there exists a definite relationship between energy consumption and normal weather data. By the use of this relationship it is possible to estimate with reasonable accuracy the revenue to be expected from air conditioning customers.

Originally the base temperature of 65° F was selected for use in estimating heating requirements by plotting average steam consumption against average monthly temperatures. When this is done the points obtained fall reasonably close to a straight line and indicate that steam consumption is directly proportional to the difference between 65° F and the average monthly temperature.

Following this line of attack Fig. 2 was drawn, plotting monthly energy consumption against average monthly temperatures. It will be noticed that the points shown in this curve fall reasonably close to a straight line and indicate that energy consumption is directly proportional to the difference between 65° F and the average monthly temperature.

In preparing this figure it was noticeable that a number of months with low average temperatures had in them spells of a week or more of hot weather, with consequent energy consumption. These months do not follow the trend indicated by warmer months. For example, September, 1934, had an average temperature of 65.8° F, although it contained seven days with maximum temperatures of 85° F or higher.

Fig. 2 is based on the *average* consumption of a large group of customers. When similar figures are drawn for individual customers they follow the same pattern, but indicate base temperatures varying from about 60° F, in the case of restaurants and other customers with heavy loads for people, lights, etc., to 70° F in the case of residences and other customers where weather is the major factor.

When this study was started it was expected that the base temperature would be 70° F or higher. The indicated base of 65° F is so much lower than expected that additional studies were undertaken as a verification. In Figs. 3, 4, and 5 are plotted the per cent of the total annual energy consumption occurring during each month of the three summer seasons studied. In the same figures are shown the monthly variation in "Degree Days Above 65° F," above 70° F, and above 75° F. These figures show very clearly that the variation in energy consumption follows closely the variation in "Degree Days Above 65° F"; also that there is much better agreement with "Degree Days Above 65° F" than with

TABLE II—KANSAS CITY, MO.—DAYS W.B. TEMPERATURES WERE EQUALED OR EXCEEDED

(HIGHEST OR 7 A.M., NOON, AND 7 P.M. READINGS)

May 1 to October 15 Inclusive

W.B. Temp.	*Cum. 1933 Total*	*No. Days Equ. or Exc. W.B. Temp. 1934*	*1935*	*1936*
80	..	..	3	..
79	1	..	6	..
78	5	..	12	2
77	8	8	20	2
76	15	14	32	10
75	24	21	39	24
74	34	32	46	43
73	45	44	51	54
72	54	53	59	67
71	64	70	66	72
70	73	78	75	78
69	81	85	82	86
68	88	91	85	92
67	100	96	90	102
66	103	99	97	108
65	111	109	104	116
64	121	112	106	119
63	132	120	108	120
62	136	127	112	124
61	136	134	114	132
60	139	137	119	139

degree days above the other base temperatures. As an additional check, similar curves were drawn to a large scale and the degree days for the intermediate bases were included. These additional curves verify the use of 65° F as a base.

Fig. 6 shows the monthly energy consumptions plotted against the monthly "Degree Days Above 65° F." It will be noticed that the points obtained in this manner fall surprisingly close to a smooth curve. May, 1934, is the sole exception to this statement. For this month the collection of records was just beginning, and the number of customers included quite small. (For this month the totals are 221 degree days and 156 kwhr per hp.)

Although it appears from these investigations that the figure for "Degree Days Above 65° F" can be used satisfactorily in estimating the revenue to be expected from air conditioning customers, the important factor of relative humidity has been entirely neglected. Consequently it appears desirable to check to see whether the outside wet bulb temperatures, as shown by weather bureau records, have any traceable effect on energy consumption.

Table II, compiled from weather bureau records, shows the number of days each year during which the oustide wet bulb temperatures equaled or exceeded various figures. A comparison of Table II with Table I will show that the maximum energy consumption occurred during the years with lower wet bulb temperatures. Thus it appears that relative humidity does not have enough effect on energy consumption to be taken into consideration in a study of this kind.

As a possible explanation of this lack of correlation between relative humidity and energy consumption, the great majority of all air conditioning systems in this locality is controlled by thermostats, with no provision for humidity control.

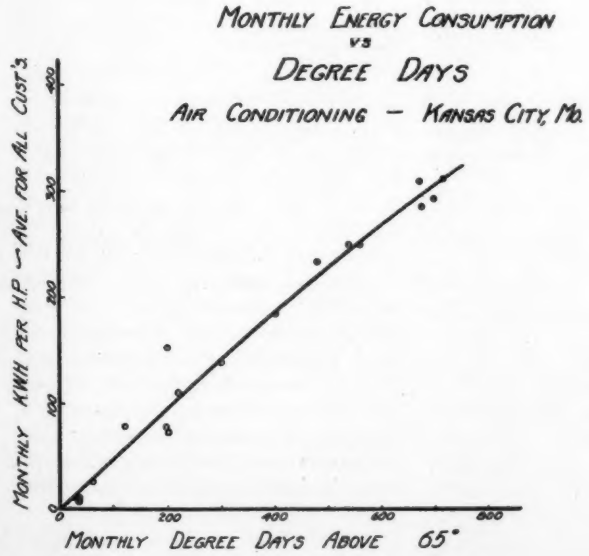


Figure 6

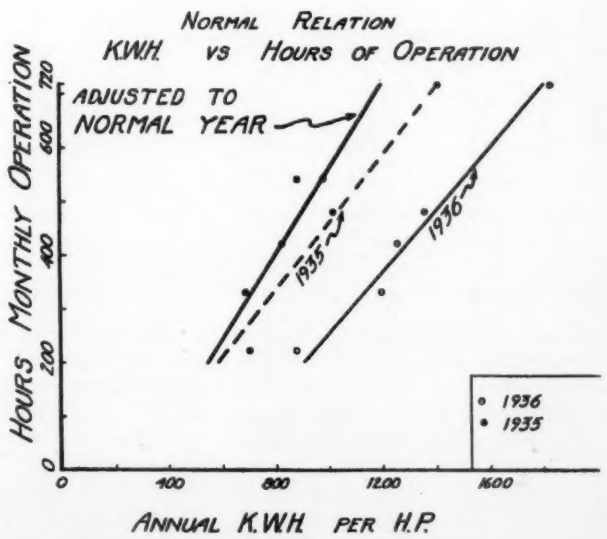


Figure 7

TABLE III—DEGREE DAYS ABOVE 65°, KANSAS CITY, MISSOURI

Year	May No. Days	June No. Days	July No. Days	August No. Days	September No. Days	October No. Days	Annual Total
1890	75	363	481	268	81	21	1,289
1891	36	220	230	276	215	40	1,017
1892	28	306	339	359	172	52	1,256
1893	48	245	393	264	254	59	1,263
1894	99	300	363	410	173	52	1,397
1895	131	242	290	322	308	0	1,293
1896	169	241	385	390	100	12	1,297
1897	79	322	478	309	368	103	1,659
1898	102	331	379	368	240	43	1,463
1899	124	282	346	446	174	113	1,485
1900	122	270	378	470	231	81	1,552
1901	66	418	683	440	190	46	1,843
1902	174	182	390	349	47	32	1,174
1903	84	155	424	309	130	25	1,127
1904	52	188	306	285	202	39	1,072
1905	60	311	290	411	184	42	1,298
1906	147	254	327	393	239	13	1,373
1907	58	219	419	367	157	15	1,235
1908	140	205	351	332	261	34	1,323
1909	52	252	397	481	160	68	1,410
1910	30	240	429	323	158	76	1,256
1911	224	469	443	404	268	24	1,832
1912	179	187	461	380	204	33	1,444
1913	120	349	512	633	205	58	1,877
1914	138	406	488	410	186	38	1,666
1915	82	163	299	183	190	29	946
1916	123	181	569	437	157	46	1,513
1917	40	250	462	257	154	20	1,183
1918	173	451	424	577	70	58	1,753
1919	56	329	524	358	234	53	1,554
1920	74	255	368	268	203	71	1,239
1921	187	363	498	372	260	29	1,709
1922	87	377	373	422	240	68	1,567
1923	63	274	445	389	154	5	1,330
1924	29	227	302	412	74	76	1,120
1925	93	347	423	409	324	21	1,617
1926	163	231	431	435	204	19	1,483
1927	83	191	372	207	278	71	1,202
1928	132	132	418	384	123	91	1,280
1929	72	246	421	412	146	20	1,317
1930	81	256	550	474	232	65	1,658
1931	87	438	519	344	385	85	1,858
1932	126	347	507	422	146	25	1,573
1933	124	507	491	344	336	19	1,821
1934	221	545	721	568	122	62	2,239
1935	36	220	675	483	199	31	1,644
1936	203	406	706	680	304	35	2,334
Totals	4,872	13,693	20,480	18,236	9,442	2,118	68,841
Average	104	291	436	388	201	45	1,465

TABLE IV—ENERGY CONSUMPTION—AIR CONDITIONING

Month	Normal Deg. Days Above 65°	Normal Kwhr Per Hp	Normal % of Annual Total
May	104	51	7.4
June	291	137	19.9
July	436	201	29.2
August	388	180	26.1
September	201	97	14.1
October	45	23	3.3
Totals	1,465	689	100.0

TABLE V—ENERGY CONSUMPTION VS. HOURS OPEN PER MONTH

Based on Normal Year

Hours Open per Month	Hours Possible Operation per 6 Mo. Season	Kwhr per Hp	Hours Actual Operation (1 Hp = .9 Kw)	% Actual Is to Possible
720	4,320	1,200	1,332	30.8%
660	3,960	1,120	1,120	31.4%
600	3,600	1,050	1,165	32.4%
540	3,240	975	1,083	33.5%
480	2,880	895	994	34.5%
420	2,560	820	911	35.6%
360	2,160	745	828	38.3%
300	1,800	670	744	41.3%
240	1,440	590	656	45.5%
200	1,200	540	600	50.0%

Customers are in the habit of watching thermometers, without paying attention to relative humidity. Probably an industrial installation, where humidity is controlled with relatively narrow limits, would show a closer relation.

The studies outlined above appear to show clearly that the revenue to be expected from a group of air conditioning customers can be estimated from past records with reasonable accuracy by the use of the figures for "Degree Days Above 65° F." Table III, which has been compiled from local weather bureau records, shows these figures for the past 47 years. This table gives some idea of the amount of variation which can be expected in energy consumption.

By using the figures for average monthly degree days, as obtained from Table III, it is possible to get from Fig. 6 the average energy consumption for each month of a normal year. These figures are shown in Table IV, which indicates that for a normal summer the energy consumption of air conditioning installations in Kansas City should average 689 kwhr per hp.

This information is of value to a utility estimating the revenue to be expected from a large group of air conditioning customers, but it is incomplete in that it does not include any factor for the hours of daily operation. In an effort to take this factor into consideration, Fig. 7 was drawn. In this figure the average kilowatt hours per horsepower used during 1936 by those customers operating 720 hours per month is shown as one point. Similar points are shown for other classes of operation, and a curve is drawn showing the relationship existing in 1936. The two customers operating 540 hours per month were ignored in drawing the curve, because for various reasons they are not representative installations.

A similar curve is shown for 1935, although the data for 1935 are less com-

plete than for 1936. By adjusting the points on these two curves to normal, using the variation between actual and normal "Degree Days Above 65° F," the line marked "Adjusted to Normal Year" is obtained. The points on this line are listed in tabular form in Table V.

By using Tables IV and V it is possible to estimate with reasonable accuracy the probable energy consumption of a given customer during a normal summer. For example, assume that a customer operating twelve hours a day, Sundays included, is installing 25 hp in air conditioning equipment. From Table V it is seen that the total energy consumption should be 745 kwhr per horsepower, or 18,625 kwhr per year. From Table IV this should be divided as follows:

May	7.4%	1,380	kwhr
June	19.9%	3,700	"
July	29.2%	5,440	"
August	26.1%	4,860	"
September	14.1%	2,630	"
October	3.3%	615	"
Totals	100.0%	18,625	kwhr

Attempts to forecast the growth of air conditioning load are dangerous, because of the many factors whose effect cannot be foreseen. However, in the warmer climates it seems generally accepted today that before many years a large majority of all places of business will have air conditioning. The growth in the domestic field is more difficult to foresee, but a careful study of past experience in this field and in the automobile and refrigerator fields should make possible an estimate which can serve as a basis for present planning.

In most cities which lie in the South or middle portions of the country and do not have industrial loads completely overbalancing those of their other customers, a study of present and future air conditioning loads will indicate the probability that summer peaks will soon exceed winter peaks by a wide margin. If and when this occurs, our problems in distribution and our rate structures will undergo extensive changes.

In view of the importance which the air conditioning load is assuming already in the utility picture, we need to sit up and take notice—and do so *now*. Not all utilities will care to make studies as complete as those described here, but surely every utility needs to give the matter careful consideration. Before this can be done it is necessary at least to keep records on present air conditioning installations.

SALES—ELECTRIC REFRIGERATORS

(Household Models Only)

MONTH OF MARCH AND FIRST THREE MONTHS OF 1937-1936

	Month of March 1937	Month of March 1936	Month of February 1937	First Three Months 1937	First Three Months 1936
Total United States	352,582	272,139	245,718	769,705	570,959
Maine	1,202	995	1,057	2,731	2,247
New Hampshire	1,028	880	644	2,221	2,111
Vermont	928	530	780	2,078	1,225
Massachusetts	18,064	9,985	11,539	36,061	22,376
Rhode Island	1,853	1,458	1,750	5,094	3,262
Connecticut	7,770	4,404	4,989	17,016	8,995
Total New England	30,845	18,252	20,759	65,201	40,416
New York	34,334	26,963	26,811	77,960	57,959
New Jersey	14,794	13,413	8,910	30,380	26,782
Pennsylvania	28,891	23,571	25,767	70,396	48,506
Total Middle Atlantic	78,019	63,947	61,488	178,736	133,247
Ohio	27,288	15,369	18,132	54,918	32,994
Indiana	10,686	8,024	7,107	21,882	17,034
Illinois	26,628	19,392	19,262	59,714	39,082
Michigan	17,540	10,167	12,269	38,328	23,369
Wisconsin	7,827	4,433	6,707	19,440	9,624
Total East North Central	89,969	57,385	63,477	194,282	122,103
Minnesota	7,395	3,477	2,953	13,409	8,568
Iowa	5,801	4,599	4,879	14,380	9,599
Missouri	12,765	11,460	7,016	24,718	20,201
North Dakota	541	571	657	1,573	1,442
South Dakota	1,114	804	562	2,163	1,972
Nebraska	2,964	2,553	2,139	6,768	5,472
Kansas	4,436	4,016	2,629	9,759	7,965
Total West North Central	35,016	27,480	20,835	72,770	55,219
Delaware	713	476	473	1,473	991
Maryland	4,398	3,347	2,718	8,883	6,691
District of Columbia	2,400	2,765	1,384	4,698	5,280
Virginia	4,670	4,030	3,618	10,974	8,478
West Virginia	4,115	3,340	3,393	9,113	6,569
North Carolina	5,864	5,810	5,565	15,303	11,073
South Carolina	3,102	2,923	2,612	7,586	5,310
Georgia	5,161	4,393	4,665	13,920	8,538
Florida	2,560	2,375	2,660	9,623	6,713
Total South Atlantic	32,983	29,459	27,088	81,573	59,643
Kentucky	4,456	4,103	2,901	8,609	8,169
Tennessee	5,437	5,087	4,255	12,259	9,238
Alabama	3,655	3,909	3,222	8,374	6,888
Mississippi	1,427	1,643	1,346	3,610	3,089
Total East South Central	14,975	14,742	11,724	32,852	27,384
Arkansas	2,463	2,299	1,301	4,398	4,716
Louisiana	2,697	3,060	2,762	6,952	6,794
Oklahoma	3,973	3,608	2,759	8,076	8,316
Texas	14,051	11,636	9,863	30,074	24,565
Total West South Central	23,184	20,603	16,685	49,500	44,391
Montana	1,707	1,208	1,181	3,473	2,685
Idaho	1,538	1,730	977	3,457	3,396
Wyoming	670	418	271	1,211	889
Colorado	2,347	2,162	2,174	6,121	4,441
New Mexico	650	618	574	1,493	1,311
Arizona	1,192	1,570	1,021	2,863	3,030
Utah	2,487	1,976	1,262	4,566	4,414
Nevada	396	315	251	837	840
Total Mountain	10,987	9,997	7,711	24,021	21,006
Washington	6,667	4,025	3,476	13,140	10,850
Oregon	3,591	3,385	1,894	6,846	7,378
California	26,346	22,864	10,581	50,784	49,322
Total Pacific	36,604	30,274	15,951	70,770	67,550

Figures based on report by the National Electrical Manufacturers Association.

Frank W. Smith Honored at Testimonial Dinner

FRANK W. SMITH was honored at a testimonial dinner on April 27, when some eight hundred people from all branches of the electrical industry gathered at the Waldorf-Astoria, New York, to show the esteem and affection which they hold for the retiring President of the Consolidated Edison Company.

The dinner, which was held under the auspices of the Electrical Association of New York, was presided over by Floyd L. Carlisle, chairman of the board of the Consolidated Edison Company. The speakers were William L. Ransom, A. W. Robertson, Major Edward Bowes, Owen D. Young and Merlin H. Aylesworth. A silver bowl was presented to Mr. Smith, the presentation speech being made by Oscar H. Fogg.

The esteem with which Mr. Smith is held both within and without the industry was voiced by all of the speakers, who emphasized his genial personality, perception, humor, energy, youth and sympathetic understanding.

Mr. Smith's speech at the conclusion of the dinner was one of encouragement to the industry. "Do not be disturbed," he said in speaking of those who were attacking the industry. "They would tear down, but it cannot be done. The superstructure is on too sound a basis."

Fifty-seven years ago last January Mr. Smith, then a boy of 12½ years, secured a job with the then infant electric lighting business as office boy of the United States Illuminating Company, forerunner of the United Electric Light & Power Company, of which he was later to become vice-president and general manager. He is the only one who has traveled the entire route of office boy to president of the electric utility system that serves America's largest city.

The United company, with which Mr. Smith was identified most of his business life, was active in the promotion of alternating-current service, and under his management it pioneered in the development of the automatic network distribution system.

Mr. Smith has been especially interested in industry association and cooperative affairs. He is a past-president of the National Electric Light Association and was for years chairman of its Lamp Committee and a member of the Public Policy Committee. He has also taken an active part in Edison Electric Institute affairs. He is a member of the Board of Trustees and has been Chairman of the Prize Awards Committee for several years.

Although Mr. Smith does not reach retirement age until June 22, he stepped aside as President of the Consolidated Edison Company at the time of the annual meeting in March, when he was succeeded by Ralph H. Tapscott.

Kohlhepp Heads Wisconsin Utilities Association

C. E. Kohlhepp, vice-president and treasurer, Wisconsin Public Service Corporation, has been elected president of the Wisconsin Utilities Association for the fiscal year beginning May 1.

MR. KOHLHEPP

Mr. Kohlhepp has been a member of the Association since its organization in 1922, was the first chairman of the Accounting Section and since 1933 has been treasurer of the Association. Currently he is chairman of the Accounting Section, Edison Electric Institute.

Other officers elected for the fiscal year are: Bruno Rahn, Milwaukee Gas Light Company, vice-president; Henry Dropp, Milwaukee Gas Light Company, treasurer. R. M. Hougher, Wisconsin Hydro Electric Company, was elected chairman of the General Section and Howard Cooper, Wisconsin Power and Light Company, was named vice-chairman.

Employees Tribute to Colonel Knight

AN unusual tribute was paid to Col. Peter O. Knight of Tampa, Fla., on the forty-fifth anniversary of his founding of the Tampa Electric Company. A full page of the Tampa *Morning Tribune* on April 12 was devoted to a "birthday" letter to which was appended the facsimile of the signatures of the company's 648 workers.

The letter, described as "a public birthday card" and addressed to Col. Knight "from his fellow employees of the Tampa Electric Company on the occasion of the company's forty-fifth birthday," read:

"Forty-five years ago this week you organized the company that is doing so much for this community and is the source of security and self-respect for each of the 648 undersigned workers of the Tampa Electric Company. Some of us have been with you ever since almost the beginning. Many of us have worked with you longer than we have worked at any other job. All of us, regardless of our length of service, have found our associations with you the happiest we have ever known.

"We want you to know, and we want the people we serve to know, just how we appreciate what you have done to make ours a happy family. We have never looked upon you as a 'boss.' Always you have been our friend. The kind of friend who stands by in time of need; the kind of friend who says 'thank you' for a job well done. We know that nowhere has a man charged with responsibilities that are yours—responsibilities to the public which we serve, to your employees and to your stockholders—been able to so endear himself to the people who work for him. Such a record, for so many years, can come from but one source—an inherent understanding and love of one's fellow men."

Forward With the National Kitchen Modernizing Program

By George E. Whitwell

Chairman, National Kitchen Modernizing Bureau

THE intention of this article is first, to correct some misunderstandings which have arisen concerning the objectives of the National Kitchen Modernizing Bureau and then to give a quick summary of progress.

The Aim of the Bureau

Three years ago some progressive representatives of electric utility companies and of electrical manufacturers came together to discuss the merits of Kitchen Modernizing as a sales approach—as a means of selling kitchen electrical equipment and of increasing electric load. It was a relatively new thought. It had been tried in a very few cases and seemed to offer excellent possibilities. Homemakers were becoming more and more interested in modern kitchens, and the time seemed ripe for a real test of the idea.

After some lapse of time, necessary for organization, the National Kitchen Modernizing Bureau was established and has now been functioning for a year and a half.

It became clearly evident well before the close of the first year that we had picked a winner. Not only did homemakers respond readily to the Kitchen Modernizing approach so that most satisfactory sales of electrical equipment resulted, but, in many places, it was found that speculative builders were exceedingly responsive, discovering in the all-electric kitchen an appeal to the home buyer which brought quick sales at satisfactory prices. In short, our experiment proved successful and we entered the second year of activity *knowing with certainty that the Kitchen Modernizing sales approach was a sure fire way to sell electric kitchen equipment and build domestic load.* The aim of the National Kitchen Modernizing Activity is just that—to get the electrical industry everywhere in this nation to realize the value of this selling means and to employ it profitably.

With such a simple and clear-cut purpose, I have been occasionally amazed at certain misconceptions that have arisen.

MR. WHITWELL

Let me lay by the heels two such misunderstandings.

Here, let us say, is a utility company which wants to initiate a campaign to sell electric ranges. They do not want to put on an electric kitchen campaign because, they repeat, their object is to sell electric ranges. In the light of the past year and a half of actual experience, I can only ask, "How better can you sell electric ranges than by employing the Kitchen Modernizing approach?" Consider, if you wish, all the sales of other electric kitchen equipment which will also be made by this approach as a mere plus value, you will still sell more electric ranges than by any other means yet discovered. Or, perhaps, the major local object is to sell electric refrigerators, or possibly electric water heaters. If so, the same logic applies and I am certain that the Kitchen Modernizing sales approach is the most effective way to accomplish these specific purposes.

I want to make it very clear that the practical aim of the Kitchen Modernizing Activity is in no sense at variance with the individual effort to sell electric refrigerators, ranges, water heaters, or other electrical equipment. Kitchen Modernizing is simply a proved, effective way to sell any of these items which you may wish to stress.

Field reports not infrequently state that certain communities and certain utility companies cannot participate in our program because it is not feasible in these communities to establish local Bureaus. Perfectly good reasons are recited why it is not practicable to set up local Bureaus—the community is too small, sufficient funds cannot be raised, etc. In such cases it is readily granted that the establishment of local Bureaus, or their equivalent through existing local electrical trade organizations, is not practical. But what is to prevent the use of the Kitchen Modernizing sales approach in individual advertising and selling in such localities by the utility company, by each electrical dealer and distributor? That is our basic aim and not the mere establishment of local Bureaus. Where local functioning and local selling through Kitchen Modernizing can be better carried on without the creation of a local Bureau, be assured that such a course has the hearty endorsement of the National Kitchen Modernizing Bureau and is entirely within the scope of its object. I may say that it is not the purpose of the National Kitchen Modernizing Bureau to dictate how you shall apply the Kitchen Modernizing approach locally. Through our central office and field forces we will gladly help you as best we can through experience but offer no inflexible program of local operation.

Record of Progress

It is often difficult to report accurately the progress of a national industry movement because so frequently the spokesman has no true picture of the national progress and can speak only in generalities or from isolated cases.

We are fortunate in the National Kitchen Modernizing Bureau in having eighteen interested and active Regional Directors as well as a constantly traveling force of field representatives. As a

result of their continuous reports we do know what is happening in the way of electric kitchen organization, promotion, and selling throughout the country. While the number of local Bureaus is in no sense a criterion of success, their increase in number is at least one measure of growth.

At the beginning of 1937, there were 61 active local Bureaus and 27 additional cities where it was expected that local Bureaus would soon be formed. There are 91 live Bureaus and 32 additional cities in which we may expect that Bureaus will soon be operative.

As to definite progress, I shall simply quote a few highlights from recent reports of several Regional Directors. Please bear in mind these are just new developments or newly available facts pointing to the growth and spread of Kitchen Modernizing activities. I cannot hope to cover here the hundreds of established local operations with which I must assume followers of Bureau activities are already familiar.

Julius Daniels, speaking for the New England Region, reports that 33 representatives of 21 operating companies gathered at Northampton, Mass., and set up an all-New England Kitchen Planning Institute for the assistance of utilities, electrical dealers, distributors, and home owners in the whole area. The cost for kitchen plans is made quite nominal. Most of the utilities represented either have demonstration all-electric kitchens in their properties or are in process of setting up such kitchens.

In six months the Boston Edison Company made up 229 kitchen plans and sold one or more units of electrical equipment to 182 of these prospects, or a batting average of 79 per cent. He mentions fine new progress by Public Service Company of New Hampshire and by Bangor Hydro-Electric Company.

C. P. Golding, Regional Director for Western Massachusetts and Connecticut reports two special "kitchen dealers" as set up, one at Pittsfield, Mass., and one at Danielson, Conn. This is in the nature of an experiment, with other special dealers to follow if the plan succeeds.

Hartford, Conn., is now launching a prize contest for the best all-electric kitchens in various classes.

A conservative estimate is that between 400 and 500 planned kitchens have been sold in western Massachusetts and Connecticut during the past year and that newspapers in the territory have devoted 34,000 lines to the subject of electric kitchens.

In reporting for New York State, Regional Director G. J. Reichert cites among other activities those of the Brooklyn Edison Company which is conducting a large and successful campaign on Kitchen Modernizing and Niagara Hudson System Companies in which the planned electric kitchen is an important part of their Five Star Home Campaign. He estimates more than 125,000 lines of newspaper editorial matter in the area on electric kitchens during the year past.

Regional Director D. E. Stultz reporting for his area, mentions new activity in Philadelphia, especially in cooperation with speculative builders, and cites as other examples the excellent functioning of the Allentown Bureau with its 31 members representing all local interests which have a part in Kitchen Modernizing; Washington, D. C., with the continuation of its program which sold 1,149 complete electric kitchens in 1936; Reading with a brand new Bureau; West Penn Power Company with 150 kitchen plans to its credit in three months' time; and new activity by Eastern Shore Public Service Company and Potomac Edison Company.

C. A. Collier, reporting for Georgia, cites a very complete new plan of Kitchen Modernizing now in operation throughout the properties of the Georgia Power Company. With their activity built around kitchen modernizing, 4,000 electric ranges were sold in 1936.

R. B. Roberts, Florida Director, says that 80 per cent of kitchen plans made by Florida Power Company have resulted in sales of one or more major kitchen appliances and that two extensive advertising campaigns are set up for the present year. Florida, apparently, is being liberally sprinkled with demonstration electric kitchens by Florida Power Company, Tampa Electric Company, and Florida Public Service Company.

Says Regional Director H. A. Keys, "The local Bureau was formed in Milwaukee only in September, yet 22 homes are now equipped with all-electric kitchens and more are in progress."

Immediate Bureau formation is under way in Chicago.

E. W. Ashmead, Regional Director for Tennessee and Alabama, speaks of continued good work at Chattanooga, Knoxville, Birmingham, and Nashville.

R. C. Geppert, Regional Director for the Midwest across the Mississippi, reports a new Kitchen Modernizing campaign employing 30 radio broadcasts in Omaha.

Director A. A. Brown has outlined a new program of Oklahoma Gas and Electric Company in special cooperation with speculative builders and tying in Kitchen Modernizing to their "Reddy Kilowatt Home" activity.

Model kitchens have now been set up in all Texas communities of over 10,000 population. In Ardmore, Okla., a prize contest on reasons why a kitchen should be planned was successfully conducted.

Director L. A. Lewis for Eastern Washington, Idaho, Utah and Montana states the gratifying news that an entire meeting of the Northwest Electric Light and Power Association was devoted to the Kitchen Modernizing Program and that local Bureaus have been organized by every utility company in the region.

A. C. McMicken, Regional Director for Western Washington and Oregon, says that seven kitchen planners are being kept busy in his region and that 429 plans have been made within the past 10 months and that kitchens installed represent 63 per cent as fulfillment of these plans.

Here are merely some of the newer highlights on what is going on throughout the country on the Kitchen Modernizing Activity. These are the straws which show the trend toward industry's acceptance of this Program. I cannot help but feel that even the casual observer can see its rapid growth and recognize its high value to the industry now and in the future.

Meter Short Course

THE Annual Short Course and Conference on Electric Meters and Relays will be conducted May 31 through June 5, by the College of Engineering, University of Florida, Gainesville, Fla., in conjunction with the Florida Metermen's Association. Utilities and municipalities, principally in Florida, Georgia, Alabama and South Carolina, and others in the electrical industry expect this conference to be most instructive and beneficial. New technical developments and the increasing exacting demands of the industry present problems of great importance to the practical meterman and relay operator. The major part of the discussion probably will be devoted to analysis and solution of these problems.

Executive Control of Public Utility Fleet Operations

By Francis B. Flahive

Comptroller, Columbia Gas & Electric Corporation

Excerpts from a paper presented at the Transportation and Maintenance Regional Meeting of the Society of Automotive Engineers, Baltimore, April 15-16

I WISH to take this opportunity to congratulate the S.A.E. on inaugurating this activity. I know of no other industry which has to be as careful of the way it spends its money or has to render as efficient continuous service as do the utilities. The customer today demands complete service, which can only be rendered by the use of this modern system of transportation—the automobile. Yet I believe that there is no single phase of our operations which is as little understood (or I might say, practiced) as the efficient and economical operation of our motor vehicles. This, perhaps, is to be expected, since the use of the automobile as a tool is relatively new. The major emphasis to date has been placed on the production of cars as is evidenced by the system of turning out new models every year. It is now time that we really learn how to utilize this remarkable tool in an efficient manner and, for that reason, I cannot but feel that you men assembled here represent a forward step in this direction.

Fortunately, many and perhaps the majority of us here today are connected with the utility industry, so at least we are among friends and talk the same language. That, it seems to me, is always a big advantage, especially for the speaker, as there is less chance of his being misunderstood.

Present day methods of conducting business make it imperative that motor transportation be used by practically every type of industry. The motor car has become so indispensable that business would practically stop if all cars should suddenly be ruled off the road. In no place is this more true than in the public utility business. From the number of vehicles we use, one might almost think we were delivering our gas and electricity by means of motors—and their number is increasing.

To start with, it might be well if I try to explain just what we are going to discuss this morning. My subject, "Executive Control of Public Utility Fleet Operations," may have different meanings to different persons and I do not desire to sail under false colors. Therefore, a word of explanation.

Basically and fundamentally, Executive Control is nothing more than plain, everyday management—the same management which we all have to exercise in our everyday lives, the running of our households, the care of our personal finances and the use of our time, whether for business or pleasure.

What direct control is exercised by the executives of these large systems over the fleets of the several operating companies?

Probably but little, as corporate officers of any organization are primarily concerned with the product that they are making. As the steel man thinks in terms of the production and sale of steel, the textile manufacturer in terms of the production and sale of cloth, so the utility man thinks in terms of the production and sale of gas and electricity. And believe me, gentlemen, today the major problems concerned with the production and sale of gas and electricity (together with a few regulatory problems) are enough to occupy the full time of any executive. Details must be left to others.

Under these circumstances it is not surprising to find that the average public utility executive, even though he may not admit it, has probably, in the past, paid too little attention to the operation of the cars and trucks which today form such an important part of his business. Especially, as I have stated before, since the growth of the use of automotive transportation has been a gradual one and basically does not actually enter into the production, transmission or distribution of either gas or electricity, being merely a tool—a very useful one to be sure, supplying an auxiliary service.

The necessity for "pinching pennies" during the depression years forced management to watch where every dollar was going, and it was then that some utility executives did realize that their automobiles were costing them a lot of money. A company with a thousand vehicles discovered that this involved an investment of a million dollars in cars, another half million in garages and still another three-quarter million EACH YEAR in operating costs. Even in this day of large figures, a million dollars is still a lot of capital—and well worth keeping an eye on.

To illustrate the executive knowledge, or lack of knowledge, concerning motor transportation, I have in mind a certain company which had a considerable number of vehicles. This cost of operation (which had come to the attention of the officials of the company) was deemed excessive. Believing in action, they hired a new transportation superintendent and informed him that they expected this fleet to be run at a cost not to exceed 15c per mile. The new superintendent, without much trouble, succeeded in reducing the average cost to 9c per mile, and the officials were more than satisfied. The point I wish to make is that the officials really had no conception of what the unit cost of operation should have been. I do not know the details, but even 9c per mile might have been an extremely high figure. The 15c per mile was certainly an arbitrary figure—merely a guess—probably based on their previous costs which they had reason to believe were entirely out of line.

Incidentally, while speaking of "cost per mile," I believe that there is one service the S.A.E. can do for the fleet operator that would be of everlasting benefit. To my mind, it is so fundamental and important that I am surprised it has not already been done. And that is, to set up a standard of measurement (or yardstick) for the purpose of comparing the performance of motor vehicles in regular operation. The "cost-per-mile" figure which is in general use today is totally inadequate. Accounting methods and procedures vary too greatly and even if

they were the same, how can you compare the cost of operating two identical vehicles if, through the necessity of business, one car has to purchase gasoline from a service station at 20c per gallon, while the other can be serviced at the company garage where gasoline is obtained at 12c? No, indeed! Cost per mile figures on such a basis are not comparable—in fact they may be misleading. I have heard it said that a uniform system of measuring the efficiency of motor vehicles *is an impossibility,* but I don't like the word "impossible" and I believe that some method of comparison can be found which would be far better than our present one of "cost-per-mile."

But to return to our subject of "Executive Control of Public Utility Fleet Operations." You want to know how it can be done in large organizations of the decentralized variety. Without question there are several methods, all of which may be equally effective, and far be it from me to state that any one system of control is better than another. The mere fact that various systems are being used today by some of our largest and best managed companies indicates that of these various systems all have value.

Perhaps the *first method* that comes to mind is what may be called "direct control." This system is the most simple to understand and likewise to operate. The parent company sets up a transportation department, headed by a man of executive ability and automotive experience. This department has complete charge of all transportation policies, passes on all requisitions for the purchase of transportation equipment and supplies, directs operations and maintenance through a system of inspections and, in some cases, goes as far as the actual designing of certain equipment.

A variation of this system of direct control is the creation of a subsidiary company which owns and maintains all transportation equipment and leases or operates the equipment for the benefit of the utility companies.

This method of "Direct Control" has some distinct advantages. There is one central authority to assume full responsibility. The utility operating executives no longer have to worry about their motor transportation problems—one more load off their shoulders. Uniform purchasing policies with the possibilities for greater standardization and resultant savings for the fleet as a whole. A staff of experts to analyze the operating efficiency from the statistical figures should promote the best policies with reference to economic operations.

The main objection to such a system is that it requires too long a time to get decisions from the "main office." In other words, the same difficulties as were experienced by the attempts at central control of large industries. Also, the cost of operating such a transportation control organization might well exceed any savings effected by its work. The size of the combined fleet is, of course, the determining factor.

A *second method* of control is one that might be called "control by analysis and suggestion." In this case, the central office employs a man (I should say, an automotive engineer) who is qualified to analyze the operations of the fleet from cost and statistical figures. The responsibility for operating and maintaining the fleets remains with the operating company executives, who are free to run them as they see fit. These company executives are furnished with such suggestions as seem advisable from the analyses made by the engineer, but there is no compulsion to act on the suggestions. If they want to run Rolls-Royces instead of Fords, that is their affair. If they believe that trading-in cars every six months is a good policy, they may do so. The suggestions from the central office merely point out what these policies are costing them and they may or may not act accordingly.

This method of control has the big advantage of being inexpensive, as one good engineer with a statistical turn of mind is all that is necessary. It is also a fairly effective method of control, as the operating executive is anxious to cut expenses and, in most cases, he will act on the suggestions offered.

This system has one outstanding objection—namely, the so-called "red tape" involved. The engineer offers his suggestions to the operating executive, who is not an automotive man. They do not speak the same language and misunderstandings are apt to occur. Then, too, the executive passes the order down the line until it finally reaches the transportation superintendent, and after passing through two or three hands, the recommendations are so changed that the engineer making them originally would not recognize his own handiwork.

A *third method* of control is one that, for want of a better name, I shall call "committee control." In some ways, it is a compromise between the first two methods which I have outlined and yet it is basically different. As it is the method used in the organization of which I am a member, I am more familiar with it than the others, and because I do believe that it is a successful method, I shall endeavor to give some details of its history and operation in our organization. I am not saying that this method is the only successful one, but it is a method which in a decentralized organization consisting of eight groups or divisions operating in as many states and having between two and three thousand motor vehicles, manages to keep considerable control at their central headquarters without interfering too much with local operations.

Prior to 1932, each of these operating divisions handled its own transportation problems, in its own way. The combined cost was in excess of one and three-quarter million dollars per year. Perhaps this figure was not excessive, but *it was a lot of money* and, conditions being what they were then, it was decided to see if this expense could not be reduced. The Board of Directors of the parent company appointed a committee consisting of one member (the man most directly in charge of motor transportation) from each of the operating groups, with an officer of the corporation (myself) as Chairman. Now, I don't pretend to know a great deal about the running of motor cars, for my profession, as I have said before, is that of an accountant, but I did represent the senior officials of the System and, as such, was in a position to direct the activities of the committee. To carry on the necessary details of administration and furnish technical advice, an automotive engineer was employed. Making this man secretary of the committee gave him an official standing and enabled him to carry on certain activities in conjunction with the other committee members. Of necessity, a great deal of the detailed routine work fell to this man. That was his job.

The duty of the committee was to inquire into the practices followed in our fleet operations and to endeavor to reduce costs and improve methods if and where possible. Since the members were the actual fleet operators, they were in a position to apply such remedies as were brought out in our meetings without the usual recourse of making recommendations for executive approval. This circumvented the red tape of administration with its resulting loss of time and forcefulness.

How did this committee function? At first, it held fairly frequent meetings—once every two or three months. Meetings were informal and developed into

round-table discussions. Certain definite topics were brought up by the Chairman and then everyone was given the opportunity to present his views and introduce his own subjects. Basically, the meetings were but an opportunity for the fellows doing the same type of work to get together and discuss their problems, air their views and exchange experiences. If a good thought was presented, it would be thoroughly discussed from every angle.

When a fleet travels 30,000,000 miles per year, as this one does, it takes a reduction of but a fraction of a cent per mile to show a sizable savings in expenditure. No one, two or three things were responsible for any increase in efficiency which may have been accomplished, as dozens of propositions were discussed, most of them tried in one form or another, and it was the combined result of all these efforts which had a salutary effect on the costs report. The total expense for operating this fleet was reduced by more than 25 per cent in four years.

You may be interested in hearing the nature of some of the subjects which were discussed at committee meetings, although they were *no different* than the ones which you transportation men are discussing every day. Retirement age of vehicles, use of lighter equipment, oil changing periods and oil filters, reclaiming oil, regrooving and retreading tires, periodic inspection of vehicles, garage practices, use of traveling mechanics, motor tune-up, training of drivers, design of special bodies, safety practices and gasoline economy—these and many others of a more minor nature, but as you see, nothing particularly new or radical.

To my mind, the important thing was not alone the subjects which were discussed, but rather the manner in which the meetings were organized and functioned. The committee members were assembled for the specific purpose of discussing the one topic of automotive transportation. They were there for a job which they were anxious to perform and the discussions were constructive rather than just academic, as is so often the case. Again the committee members were the actual transportation supervisors who could put their ideas into effect without delay and consequent loss of effectiveness.

There is one item of which I have not spoken heretofore but which, to my mind, has been of such importance that I want to take the time to make special mention of it. I am referring to that little gadget known as the throttle-stop and I take personal pride in the fact that our organization had a real part in its development. The average fleet owner *does not need* the performance and top speed which is being built into the light automobiles today. Economy of operation is far more desirable for our purpose and you know that economy and performance are not affinities. We experimented with stopping our throttle at a point where it was only about one-third open, at which point the cars had a top speed of about 55 miles an hour. This we considered a sufficient rate for business purposes. The car was a little slower in acceleration and had to go into gear on some hills, but it did have economy of operation. There was some growling from the drivers, as they are only human and, even as you and I, would like to have the best, be it in performance, speed or appearance, but that feeling disappeared when drivers were educated to the necessity for economy.

We formerly made our own throttle-stops and did our own work on the engines, but today we can all buy "Economy Models" with throttle-stops built into the car by the manufacturer.

The reason I have mentioned this story of the throttle-stop is that it received a lot of attention in our committee meetings. It was one of our members who was working with it as long ago as 1932 and as he told his story at the meetings, the other members became interested. They adopted the idea, and today 90 per cent of the entire fleet of light cars is throttle-stop equipped.

Here let me point out one fact relating to the operation of any motor fleet. It is a fact with which you undoubtedly are all familiar, but perhaps to which you have not given a great deal of thought. That is, the successful economical operation of any fleet depends upon the economical operation of each individual vehicle. Common sense, you say, and so it is, but how often do we overlook this little bit of common sense. We are very prone to lump figures together and strike an average and if the average looks reasonable, we let it go at that and pat ourselves on the back for doing a fair job.

To emphasize the oddities of averages —a recent newspaper item may be of interest. It appears that some doctor wrote to his medical association inquiring as to particulars as to XYZ disease, which he understood was prevalent with persons of *an average* age of 45. The reply he received was to the effect that the medical association had record of but two cases of such XYZ disease in the past 10 or 15 years, one in an infant, aged two—and the other with an elderly gentleman, age 90—*average* 45.

For example, suppose we have a fleet of ten passenger cars which we find have an average of 15 miles per gallon of gasoline. Not a bad average as operations are today and I'll warrant that many supervisors would be satisfied with that figure. But suppose you break that figure down to individual cars and find that five of the vehicles are getting 10 miles to the gallon and the other five are 100 per cent better, getting 20 miles to the gallon. (And don't think that these figures are fantastic, for I have seen even greater variations.) Five of those cars need individual attention to discover why their performance is so low. Perhaps there are reasons which are justifiable, but they should be investigated as individual cars, if the maximum economy is to be expected for that fleet. Other items of operation and expense must be treated in a similar manner.

Our subject today has been management and I wonder if, on the average, many utility fleets are really managed. You men, most of whom are operators of fleets—what is your opinion? I ask you frankly, are your fleets really managed or are they merely maintained? My observations lead me to believe that *real* fleet management is lacking in many instances today.

How many of you have really checked into the possibility of pooling cars and assigning them for company use on a dispatch system? Personally assigned cars for individual use have always been a sore spot in fleet operation.

How many have looked into the question of the low mileage cars—those cars which only average from 400 to 800 miles per month? They are found in every fleet, as you well know, and an investigation will reveal the fact that many of them are only being used for commutation service—taking some man between office and home.

Then there is the question of the right car for the particular job. I know of many cases, and so do you, where a three- or a five-ton heavy duty truck is purchased to take care of those occasional heavy loads and an analysis shows that there is actual need for them only one, two or perhaps three weeks during an entire year. And the remainder of the time this $5,000 investment is either doing jobs at 30c per mile which could adequately be handled by a pick-up or 1½-ton truck, or is standing idle.

How close a check is being kept on excessive mileage operated? High mileage may show a beautiful cost-per-mile

(*Continued on page* 198)

S.A.E. Public Utility Fleet Operation Meeting

"AN extremely successful experiment." This estimate by Vice-President John M. Orr, of the Society of Automotive Engineers, of the first SAE Regional Transportation and Maintenance Meeting devoted to Public Utility Fleet Operation was more than borne out by the enthusiasm of some 250 engineers and executives who gathered in Baltimore, April 15 and 16 to participate in the sessions. Though termed a regional meeting, public utility fleet operators came from 19 states and Canada. Colorado, Florida and Quebec were the most distant points represented.

Everybody said what he thought throughout the four technical sessions, the safety luncheon and the utilities dinner which made up the program. Circumlocution was noticeably absent. On a wide variety of topics, facts were flung boldly out; experience-borne opinions were voiced frankly.

Conceived by the Transportation and Maintenance Activity, the success of the meeting was the result of cooperative planning by the Activity and the Baltimore Section, which was host to the visiting members and guests. Each Baltimore Section officer was active on the program. Chairman W. H. Beck presided at the afternoon session of the opening day; Vice-Chairman E. W. Jahn acted as Baltimore representative of the T & M Activity and presented a paper at the Economy Symposium; Treasurer R. C. Hall was dinner chairman; and Secretary L. W. Shank was active in making arrangements.

Toastmaster at the utilities dinner was A. W. Morton, general manager, American Hammered Piston Ring Division of the Koppers Co., who introduced the two speakers, J. G. Holtzclaw, president of the Virginia Electric & Power Co., and vice-president of the Edison Electric Institute, and SAE Secretary and General Manager John A. C. Warner.

"The automotive industry and the electric power industry are twins," declared Mr. Holtzclaw in opening his talk on "How the SAE Can Be Helpful to Public Utility Operators." They were both born at about the same time, he said, and both have had a great part in advancing civilization.

The public utility industry as it is today, he continued, would be impossible without an automobile. The utilities are changing rapidly, and the SAE can be helpful by keeping automotive equipment so that it can be used as an efficient tool. It can help in developing proper maintenance methods and it can aid in keeping the utilities' transportation costs down, he declared.

Mr. Holtzclaw sees an opportunity for cooperation. The manufacturer, he said, develops his theories and gives the fleet operator something to work with, while the operator in return provides the manufacturer with a proving ground to test out his theories.

Mr. Warner emphasized the importance of the public utility fleet-supervisor's job.

"This meeting," he said, "exemplifies SAE advancement. It is the first of its kind to be held and one that seems likely to be repeated regularly, because it has a vital usefulness to a live part of the industry. Probably no branch of motor-vehicle operation has as many problems or changes so rapidly as do public utility fleets."

A few words of welcome from Vice-President Orr of the Transportation and Maintenance Activity opened the meeting's first session. Mr. Orr then turned the gavel over to Adrian Hughes of the Baltimore Transit Co., chairman of the session, who in turn introduced Prof. James I. Clower of Virginia Polytechnic Institute, who spoke on "Oil Filters in Public Utility Operation."

Aided by numerous carefully selected slides, T. C. Smith, American Telephone & Telegraph Co., at the afternoon session, traced the development of trucks used by his company for utility transportation, construction and maintenance from the "nineties" to the present. He was introduced by Baltimore Section Chairman W. H. Beck, Sherwood Bros. Inc., who presided at the session.

Captain Axelson, and H. O. Mathews, Public Utility Engineering & Service Corp., brought up the subject of standardization—Captain Axelson of bodies for utility trucks and Mr. Mathews of auxiliary power equipment. Jean Y. Ray, Virginia Electric & Power Co., believes that there is need for standardization but that changes in construction practices are working against it. His own company, he said, is developing a two-man line truck for use in making rural installations.

J. R. North, Commonwealth & Southern Corp., presented written discussion on utility trucks with standardized bodies. His company, he said, has also made an extensive study, as a result of which they have developed certain standard body designs employing all-metal construction. These are lighter, stronger and, in many ways, superior to wood or composite wood and steel bodies formerly used. These bodies are mounted low on metal sills and are adaptable to various chassis produced by different manufacturers.

A. H. Bishop, Autocar Sales & Service Co., took the chair for the Friday morning session. A paper, "Executive Control of Public Utility Fleet Operation," by F. B. Flahive, Columbia Gas & Electric Corp., opened the program. This was followed by W. R. Pollard, of the Georgia Power Co., who spoke on "Efficient and Economical Operation of Automotive Equipment of a Public Utility."

Extremely popular was the "Safety Luncheon" on Friday. It was presided over by J. R. Sherwood, senior vice-president, Baltimore Safety Council, who introduced the speaker, J. W. Lord, Atlantic Refining Co.

The Economy Symposium, at which Captain Axelson, Mr. Jahn and Mr. Ray read papers concluded the two-day meeting.

* * *

Through the courtesy of the SAE, the Institute has mimeographed copies of the following papers presented at the meeting:

Executive Control of Public Utility Fleet Operations—F. B. Flahive.

Single Property Fleet Supervision—W. R. Pollard.

Oil Filters in Public Utility Fleet Operation—J. I. Clower.

Utility Trucks, Cabs, Bodies and Auxiliary Equipment—T. C. Smith.

A Study of the Safe Driver—J. W. Lord.

Throttle Stops—O. A. Axelson.

Results in Non-Changing Motor Oil—E. W. Jahn.

Pooling of Passenger Car Equipment—Jean Y. Ray.

These papers may be secured by writing to the Editor of the BULLETIN, 420 Lexington Avenue, New York, N. Y.

National Kitchen Planning Contest Sponsored By Modernizing Bureau

KITCHEN planning contests as a means of stimulating kitchen modernizing with electrical equipment are being conducted in many cities this year. As encouragement to these local contests the National Kitchen Modernizing Bureau is offering, in a nation-wide "Plan Your Electric Kitchen" contest, cash prizes which total $3,000.

The National Contest centers about kitchen planning and the making by home-makers of miniature models of all-electric kitchens, each accompanied by a brief essay on "Why I Want a Modern Electric Kitchen." Entries will be judged on three major points: The use of electrical equipment in the model kitchen, the arrangement of both electrical and non-electrical equipment for the saving of footsteps and labor, and the general excellence of the essay, which must be limited to 200 words.

The model kitchens must include the floor and at least three walls, together with models of kitchen equipment and accessories placed according to the contestant's idea as to the best possible arrangement. Walls may be of cardboard or any other material to produce the effect of three dimensions. The equipment may be constructed in the same manner or be represented by flat drawings on walls and floor.

The model must be constructed to scale, and may be colored to indicate the decorative effect if the contestant wishes, although this is not required. For size and general location of windows the model must represent either the kitchen in the contestant's present home or in a new home which the contestant is actually building.

To qualify for the National Contest the contestant must have ranked among the winners of the first fifteen prizes in a local contest of similar nature during 1937, prior to the closing of the National Contest on November 1.

It is assumed that such local contests will be based on kitchen modernizing by electrifying, with miniature models of kitchens submitted, and that they will be conducted by a local Kitchen Modernizing Bureau, electric utility company, Electric League or other recognized local electrical organization. Each entry in the National Contest must be accompanied by a statement of the facts whereby it was awarded a local prize.

As a further aid to these local contests, the National Kitchen Modernizing Bureau has prepared a kitchen planning kit suitable for building miniature models of kitchens. The kit consists of reproductions of the parts of a kitchen and its equipment, printed and die-cut from cardboard, from which a completely equipped model kitchen, to the scale of one inch to a foot, may be easily constructed. The material is enclosed flat in an envelope with complete instructions for putting together.

The kit contains four kitchen walls and floor, marked so that they may be cut with scissors to the scale of any actual kitchen. Adhesive strips are provided to hold floor and walls together in position. Included in the kit are 26 different pieces, including all kitchen electrical equipment and the necessary accessories such as cabinets, tables and chairs. All of the equipment items may be folded and locked together, and require no glue.

Utilities and dealers will find this contest idea an effective stimulus to the sale of electrical equipment for the home.

Kits are available from the National Kitchen Modernizing Bureau, 420 Lexington Avenue, at twelve cents a set, and their use is recommended in all local kitchen planning contests.

Northwest Association Meeting

ENGINEERS were urged to effect a realistic solution of the problem of putting Bonneville to work productively by Paul B. McKee, president of Pacific Power & Light Company, April 21-23, in Portland before the engineering and operation section of the Northwest Electric Light and Power Association. Mr. McKee pointed out that "it is our duty to do everything we can to help make the Bonneville project an asset to the community."

Stability studies, co-ordinated communication, distribution economies and other problems peculiar to conditions in the Pacific Northwest were discussed. Valuable ideas were contributed calculated to assist co-ordinated load growth and inter-system development. J. D. Hertz, Pacific Power & Light Company, and C. E. Cannon, Washington Water Power Company, led the discussion. Mr. Hertz described studies being made in the application of carrier current communication to distribution lines as a means of obtaining better control over the line crews and trucks, particularly in emergencies.

P. P. Ashworth, Utah Power & Light, pointed out the fallacy that low-cost power is a primary factor in attracting industry to a locality. By actual surveys among industrialists power was placed ninth to twelfth down the list of plant location factors. Mr. Ashworth stated that for this reason load growth depends upon more normal growth of communities and increasing utilization of existing customers rather than an influx of new industry to the Northwest.

O. L. LeFever, Northwestern Electric Company, described recent developments in protection against oil fires. Other speakers included W. C. Mainwaring, B. C. Electric Railway; George Wistling, Northwestern Electric; Joe Hellenthal and M. T. Crawford, Puget Sound Power & Light; L. R. Gamble, Washington Water Power; J. D. Ellis, Northwestern Electric; H. L. Melvin, Ebasco Services; R. J. Davidson, Pacific Power & Light; L. E. Kurtichanoff, U. S. Army Engineers, and J. O'R. Coleman, Edison Electric Institute.

Tom Purton, Idaho Power, was elected chairman for the coming year and A. Vilstrup, B. C. Electric Railway, vice-chairman.

The four-day meeting was attended by more than 200 delegates from Oregon, Washington, Montana, Idaho and British Columbia. Technical papers on many phases of electrical engineering were read.

"Energy" Not "Emergency" Sales

The address made at the National Sales Conference in March by Julius Daniels, Sales Manager of the Boston Edison Company, was printed under the title "Making Radio a Headliner for *Emergency* Sales." The correct word was *Energy*. Our apologies to Mr. Daniels.

Missouri Association Convention

A RECORD-BREAKING convention of the Missouri Association of Public Utilities was held at Excelsior Springs, Mo., April 21-23. The registration of nearly three hundred was the largest the association has ever recorded at a convention.

"We should not lose public favor by default," said C. E. Michel, president of the association, in his opening remarks, wherein he recommended the continuance of the advertising program which the association has conducted for years in some 500 newspapers outside of the larger cities.

This is not propaganda, but a constructive campaign of public education based on facts regarding the operations of private utilities, Mr. Michel said. He pointed out that the best way to meet advancing costs is through selling and that the dealer is needed in order to do a complete sales job.

In his address to the convention, C. W. Kellogg, president of the E.E.I., said, "Come up out of the storm cellar. The wind is not as strong as we thought it was." In fact, he pointed out, there are distinct limitations to the power of propaganda. The government propaganda is not justified by the facts. People, on the whole, are now believing that the private utilities are doing a workmanlike job. However, the industry must see to it that public confidence continues to be justified by the nature of the service and the way the public is handled.

While characterizing the utilities act as a great tragedy to the industry, he expressed the hope that the famous "death sentence" section may be eliminated or amended so as to be ineffectual.

Rural service should be considered as a separate class of service, Grover C. Neff, Wisconsin Power & Light Company, Madison, Wis., stated, with its own organization, having at least one rural service man to every 500 customers. Farms can and should use several times as much energy as urban residences, he insisted, and to attain this end rural service must be studied from the standpoint of value to the farmer. He recommended a survey to determine the size of the job to be done.

The problems of maintaining utility service under flood conditions were covered by H. C. Blackwell, president, Cincinnati Gas & Electric Company, in a talk illustrated with numerous slides.

Co-ordination of load building with system planning was suggested by S. B. Williams, managing editor *Electrical World*, New York, as one way for utilities to share in the business upturn.

In outlining the changing economies and social picture, Conrad H. Mann, former president of the Kansas City (Mo.) Chamber of Commerce, urged the utilities to educate their public and their employees with honest facts on the industry's problems.

Governor Hoffman of New Jersey also urged that the public utilities place their case before the public.

At the end of the meetings Chester C. Smith, Kansas City Power & Light Company, was elected president; E. H. Lewis, Union Electric Light & Power Company, St. Louis, first vice-president; Ben C. Adams, Gas Service Company, Kansas City, second vice-president; Oscar F. Funk, Union Electric Light & Power Company, third vice-president; Herman Spoehrer, Union Electric Light & Power Company, treasurer, and N. R. Beagle, Missouri Power & Light Company, Jefferson City, secretary.

The Objective Rate Plan

(*Continued from page* 164)

other Commonwealth & Southern Companies and other utilities throughout the country. He gives a table of the Objective Type Rates, by states and by companies, and shows how its use has been extended.

Mr. Kennedy studies the results of the plan, comparing revenues, sales and average units before and after the plan was adopted. He also presents some interesting data as to the distribution of customers by kilowatt hour blocks and notes a distinct trend in the shift of customers into the higher consumption blocks. He also shows how rapidly the customers move over to the Objective Rate from the Immediate Rate.

The Objective Rate Plan has met some objections because of apparent discrimination which results under its application. Mr. Kennedy has discussed this phase of the subject quite fully and concludes that "If there were serious discrimination under the Objective Rate Plan, actual operation for two and a half years would have revealed it. No serious complaints on this account have been made, probably because the discrimination that does exist is unimportant."

Mr. Kennedy, in his appraisal of the Objective Rate Plan, points out that there is economic necessity for the charging of differential prices for electricity for residential purposes also that there is a social justification in expanding residential electric service. He notes that the impact of hostile political action has been directed chiefly against residential rates and in view of the conditions he believes the use of differential prices for residential service is a proper and necessary move.

Mr. Kennedy points out that the most valuable contribution of the Objective Rate Plan is that it makes possible the offering of rate reductions which otherwise could not be granted because by protecting existing revenues, the plan does not expose the utility company to financial dangers of outright rate reductions.

All who are interested in ratemaking, both within and without the industry, will be deeply interested in Mr. Kennedy's analysis of the Objective Rate Plan. As a method of price fixing and of developing increased sales, the plan, as described by Mr. Kennedy will be of great interest to many who have no direct or indirect interest in utility ratemaking. —*F.N.*

Electric Water Heating

(*Continued from page* 162)

doubled the number of domestic water heating customers served by our company, until at the end of 1936 we had water heating saturation in excess of 18 per cent.

I am sure that the water heating program carried on by our company has been very satisfactory and today with the manufactured product as good as it is and with the information available regarding diversity of demand and consumption per year, the company starting an electric water heating sales program at this time has a tremendous advantage over those of us who have had to do our own experimenting. It is the hope of our committee that the majority of the companies will at least start a campaign to sell electric water heating service to their employees during 1937.

Characteristics of Power System Faults to Ground

IN connection with the study of low-frequency residuals and their control, Project Committee 2J of the Joint Subcommittee on Development and Research, with the cooperation of several power companies, has obtained numerous oscillographic records of power system currents and voltages at times of disturbances producing ground current, together with information as to the cause and nature of the disturbances. Data were obtained from ten systems which were under observation for periods ranging approximately from one to five years. These systems include a voltage range from 26 kv to 220 kv; some operate with directly grounded neutral, others with neutral grounded through impedance. The results of this study are disdussed in detail in Engineering Report No. 39* entitled "Characteristics of Power System Faults to Ground."

The data may be roughly divided into four main classes relating respectively to: (1) the monthly and yearly frequency distribution of disturbances and faults; (2) the classification of power system troubles to determine their cause

*Price 80c to members and their employees; $2.00 to non-members.

TABLE 1—SUMMARY OF RESULTS

DESCRIPTION	A	B	C	E	F	G	H	I	J	A to F	H to J
	26 Kv.	33 Kv.	33 Kv.	44 Kv.	44 Kv.	66 Kv.	120 Kv.	132 Kv.	220 Kv.	26-44 Kv.	120-220 Kv.
I. General											
1. Period of oscillograph observation—net months	63	55	39	66	15	23	31	44	60	....	....
2. Total records obtained—(a) Disturbances	147	1018	814	2588	100	85	226	34	122	....	....
(b) Faults	107	688	517	1215	75	49	182	26	110	....	....
3. Neutral resistance employed—ohms	75	30	None	136	None	60	None	None	None	....	....
4. Approximate circuit miles of transmission line (total)	170†	400	250	535	215	313	434	167	310	....	....
(a) Steel tower or pole line	None	126	None	342	None	113	....	167	310	....	....
(b) Wood pole line	140	274	250	193	215	200	....	None	None	....	....
II. Frequency of Occurrence—Per Year Per 100 Circuit Miles											
1. Number of calendar years for which data apply	5	3	3	5	....	1	....	2	4	....	....
2. Disturbances	18	52	93	88	....	13	....	6	8	....	....
3. Faults	13	35	60	41	....	8	..	5	8	....	....
	Values Below Are Percentages of Total Utilizable Records										
III. Disturbances and Faults Involving More Than One Phase Wire and Ground											
1. Disturbances	40.0	25.5	....	11.8	....	....	....	....	....	....	....
2. Faults	47.6	32.4	....	22.5	....	....	....	....	....	....	....
IV. Manner of Clearance of Disturbances											
1. Circuit breaker cleared	69.4	62.6	65.4	65.6	63.0	78.8	75.6	85.3	74.6	65.2	78.5
2. Self cleared	8.9	19.3	12.1	11.0	13.0	1.2	7.5	5.9	6.0	12.9	6.5
3. Records indicating one cycle or less duration—probably self cleared in most instances	12.9	9.6	19.4	11.9	24.0	20.0	16.0	5.9	9.0	15.6	10.3
4. Unable to classify	8.8	8.5	3.1	11.5	0	0	.9	2.9	10.4	6.3	4.7
V. Classification of Correlated Disturbances											
A. Location of Troubles											
1. On lines	60.1	76.4	80.4	61.2	46.4	60.7	53.8	69.0	61.8	64.9	61.5
2. At substations	33.1	9.5	11.3	28.9	25.0	15.5	33.9	27.6	15.5	21.6	25.7
3. Location unknown	6.8	14.1	8.3	9.9	28.6	23.8	12.3	3.4	22.7	13.5	12.8
B. Primary Cause											
1. Lightning	39.8	47.6	57.8	41.8	27.4	33.4	52.2	31.0	60.9	42.9	48.1
2. Primary cause unknown	38.4*	18.6	19.8	21.0	1.2	0	4.6	24.1φ	8.2	19.8	12.3
3. Cause, location and type of trouble unknown—probably flashovers in most instances	6.7	14.1	8.2	9.8	28.6	23.7	12.3	3.5	22.7	13.5	12.8
Sum of above—probably due to lightning in most instances	84.9*	80.3	85.8	72.6	57.2	57.1	69.1	58.6φ	91.8	76.2	73.2
4. Wind, sleet, snow, rain and flood—no lightning reported	3.0	10.6	7.8	22.0	0	16.7	0	3.4	.9	8.7	1.4
5. Foreign objects	10.6	7.9	4.5	4.8	21.4	13.1	4.6	27.6	.9	9.8	11.0
6. Switching	1.5	1.2	1.9	.6	21.4	13.1	26.3	10.4	6.4	5.3	14.4
C. Nature of Trouble											
1. Flashovers	51.0	58.4	66.8	42.2	52.4	54.7	61.5	48.2	83.6	54.2	64.5
2. Bushing failures	3.7	1.7	3.5	15.4	0	0	1.5	0	1.8	4.9	1.1
3. Equipment failures	0	2.0	4.1	7.8	3.6	0	0	6.9	6.4	3.5	4.4
4. Whipping conductors	0	.5	3.0	5.6	0	3.6	0	0	0	1.8	0
5. Conductors down—no structures reported down	3.8	14.4	14.6	13.9	7.2	10.8	6.1	13.8	.9	10.8	6.9
6. Failures of and damage to supporting structures	.8	11.3	2.8	9.1	0	8.3	0	0	0	4.8	0
7. Foreign objects—exclusive of those causing broken conductors or damaged structures, which are included in 5 and 6 above	9.9	10.5	3.1	5.0	15.4	9.5	4.6	13.8	.9	8.8	6.4
8. Switching	1.5	1.2	1.9	.6	21.4	13.1	26.3	10.4	6.4	5.3	14.4
9. Cable failures	29.3	....	.2	.4	0	0	0	6.9	0	5.9	2.3
VI. Wave Trace Characteristics											
1. Uniform	42.9	51.9	40.7	54.3	65.0	58.8	71.6	76.5	71.7	51.0	73.3
2. Uniformly attenuated	2.7	8.7	1.8	3.1	1.0	3.5	2.7	5.9	0	3.5	2.9
3. Irregular	34.0	21.2	32.3	22.7	10.0	15.3	8.8	8.8	9.0	24.0	8.8
4. One cycle or less duration	12.9	9.6	19.4	11.9	24.0	20.0	16.0	5.9	9.0	15.5	10.3
5. Unable to classify	7.5	8.6	5.8	8.0	0	2.4	.9	2.9	10.3	6.0	4.7

† 30 miles of aerial and underground cable.
* These values include 27.8% due to cable failures which were probably not caused by lightning.
φ These values include 6.9% due to cable failures which were probably not caused by lightning.

and nature, this classification being based on power system trouble reports; (3) certain characteristics of disturbances, such as duration, manner of fault clearance, and number and sequence of phase wires involved, this information being deduced principally from the appearance of the oscillographic records; (4) fault resistance and related subjects such as arc resistance, tower footing resistance, etc.

Due to the difficulty of directly measuring fault resistance, the majority of the data given on this subject in the report are based on determining a term which, when used as fault resistance in the equation for fault current, makes the *computed* current for a given fault location and system setup equal the *measured* current. This term is referred to as "apparent fault resistance," since, even when using the best information available on the impedance of apparatus and lines, the value so determined includes the effect of unknown factors which may be present.

Values of "apparent fault resistance" were determined for a total of 1375 disturbances on the five power systems for which the data proved to be adequate for such computations. The most frequently occurring values of apparent fault resistance for these systems ranged from 5 to 25 ohms. Those determined for faults at substations were generally less than for faults on lines; those determined for faults on steel tower lines tended, for the two systems for which such separation could be made, to be somewhat smaller than for faults on wood pole lines, but taking the results as a whole there appears to be no marked difference for these two types of construction . The data indicate that, where fault resistance is to be allowed for in fault current computations, 20 ohms for line and 5 ohms for substation ground-faults are reasonable values to use.

The information on arc resistance, one of the elements entering into fault resistance, is fairly comprehensive and in general the tests of different observers are in good agreement. They indicate that, above about 100 amperes arc current, the voltage per foot of arc length is practically independent of current magnitude and ranges between about 200 and 400 r.m.s. volts per foot of arc. The results offer a method of estimating during the first few cycles of an arc, that portion of the fault resistance in the arc. For longer durations of fault, such estimates are likely to be inaccurate unless some idea of the length of extension of the arc can be secured.

Data are presented which show that, even along the same line, tower footing resistances may vary widely. If a tower line carries a ground wire, it appears that in the majority of cases encountered in practice, tower footing resistance will have little effect on fault current magnitude if l, the length in miles of the section of line involved, is greater than

$$5\left(\sqrt{\frac{\text{average tower footing resistance.}}{\text{number of towers per mile}}}\right)$$

(The quantity under the radical sign is an equivalent distributed leakage resistance per mile due to tower footing resistances.) In the case of steel tower lines with high-conductivity ground wires, it seems apparent that arc resistance and tower footing resistance alone will not account for apparent fault resistances of the magnitudes given earlier, indicating that factors other than these are involved.

Results of this study concerning the durations and monthly distribution of disturbances are presented in the report in the form of a series of curves. Summarized data on other characteristics of disturbances may be found in Table 1. Sections II and V of this table are of particular interest, the former giving data on frequency of occurrence of faults and the latter an analysis of their cause and nature as indicated by the correlation data.

Dashes appearing in Table 1, in general, indicate that either no data were available for the particular classification or that they were not sufficiently comprehensive to warrant inclusion in the table. In the last two columns of the table values are quoted for certain groupings of systems. These percentage values are the average of the percentages shown for each system in the respective groups, for the particular item under consideration. This method of arriving at the average figure gives equal weight to each system included in any group. In this table, the meanings attached to the terms "disturbance" and "fault" may be explained as follows:

Disturbance—Each individual oscillograph record of abnormal 60-cycle current, irrespective of its cause or duration, represents a disturbance.

Faults—The number of faults for a given system and period was arrived at by eliminating, from the total recorded disturbances, those having a duration of one cycle or less, and those which the power system trouble records or the oscillogram characteristics indicated to be recurrences of, or reclosures on, the same case of trouble.

Executive Control of Fleet Operations

(*Continued from page* 193)

figure, but if there have been many unnecessary miles, the savings in cost-per-mile may easily be offset by such traveling of the vehicle. Unnecessary mileage is probably one of the most prolific sources of unnecessary expense in the operation of any fleet and it is probably the most difficult factor to control.

What right have we, as fleet operators to continue the use of cars that cost more to operate than other cars which could be used for the same purpose? You know and I know that there are many cases wherein a certain type of vehicle is furnished to an employee because he prefers it, even though figures show it to be less economical.

Why shouldn't we, as the collective users of great numbers of motor vehicles, have more to say to the manufacturers with reference to the type of vehicles that we need for our commercial operation? Aside from the design of truck bodies, which are practically custom-built to the specifications of each company *and for which we pay dearly,* we have made but few demands on the motor industry to supply us with vehicles built to our standards. Do we need fancy plush upholstery, dome lights, chromium-plated hardware, fancy instrument panels and all the other gadgets which come to us today as standard equipment on the modern passenger cars? It is my belief that the manufacturer has so spoiled us with these little luxuries that we are prone to accept them as necessities, even though they cost us more money.

One item which is a little thing in itself, but which mounts up because of the greater number of vehicles involved, is the use of sedan passenger cars. The economy model coupe and coach represent a lower investment than the sedan and, because of less weight, are cheaper to operate. Why, then, use sedans?

All of the aforesaid pertains to management, for, when all is said and done, management is simply a question of looking after details. It is management that is ever on the alert for omissions and for the little business indiscretions that are forever creeping into our operations. If each man would do his job and do it more nearly perfect, there would be less necessity for so many persons doing this job we call management.

POWER SALES ITEMS

AIR CONDITIONING

"Commercial Air Conditioning," by Henry G. Dooley. *Electrical World,* February 27, 1937, p. 47. McGraw-Hill Publishing Co., Inc., Publishers, 330 West 42nd Street, New York City.

A survey of the problems, policies and practices affecting the market.

"Air Conditioning and Summer Peaks," by Edward Allen. *Electric Light & Power,* April, 1937, pp. 36-39. Bennett-Watts-Haywood Company, Publishers, 360 North Michigan Ave., Chicago, Ill.

This growing load is requiring additions to system capacity. Information gleaned during a trip in the southwest should interest all utilities.

COMPRESSOR DRIVES

"Motors for Air-Compressor Drives," by M. N. Halberg. *Power,* March, 1937, p. 134. McGraw-Hill Publishing Co., Inc., Publishers, 330 West 42nd Street, New York City.

Characteristics of d.c. single-phase and polyphase a.c. motors for driving air compressors, and conditions where each is suitable.

DIESEL ENGINES

"Windom, Minnesota, Superimposes Diesels Upon Steam Plant," by P. Mc. Edmonson. *Diesel Power,* February, 1937, p. 105. Diesel Publications, Inc., Publishers, 192 Lexington Avenue, New York City.

Brief description of Diesel plant which, added to the steam plant, effected a saving of 50 per cent in operation.

"The Thermometer Is Worth Remembering." *Diesel Power,* February, 1937, p. 107. Diesel Publications, Inc., 192 Lexington Avenue, New York City, Publishers.

Thermometers should be used on water, lubricating oil and exhaust lines.

"High-Temperature Cooling Reduces Engine Wear," by Robert M. Tucker. *Diesel Power,* February, 1937, p. 114. Diesel Publications, Inc., Publishers, 192 Lexington Avenue, New York City.

Sealed-pressure, distilled-water, enclosed system, with heat exchanger, which is thermostatically controlled to maintain an engine outlet temperature of 215 degrees, prevents engine wear.

"America's Smallest Diesel." *Diesel Power,* February, 1937, p. 117. Diesel Publications, Inc., Publishers, 192 Lexington Avenue, New York City.

Brief description of 3 h.p. vertical single-cylinder Diesel engine.

ELECTRIC FURNACE

"The Electric Furnace—Its Influence on Civilization," by P. H. Brace, Westinghouse Electric & Manufacturing Co. *Metal Progress,* February, 1937, p. 184. American Society for Metals, Publishers, 7016 Euclid Ave., Cleveland, Ohio.

Some of the new metals and new products made possible by the use of the electric furnace.

INDUSTRY

"Industry on the Move." *Business Week,* February 27, 1937, p. 43. McGraw-Hill Publishing Co., Inc., Publishers, 330 West 42nd Street, New York City.

Why and where plants and industries are migrating, what the decentralization trend means, how new competition is changing the geography of industry.

INDUSTRIAL ELECTRIFICATION

"Industrial Electrification." *Electrical World,* February 27, 1937, p. 84. McGraw-Hill Publishing Co., Inc., Publishers, 330 West 42nd Street, New York City.

Four items which contain ideas for power sales:

Electric oven pays out quickly.
Welds not brittle at low temperatures.
Nut flavor preserved by electric heat.
Forming machine uses variable-speed drive.

"Industrial Electrification." *Electrical World,* February 13, 1937, p. 76. McGraw-Hill Publishing Co., Inc., Publishers, 330 West 42nd Street, New York City.

Five items which contain ideas for power sales:

Photo-cell gages coal car sprinkler.
"Statics" paid their way here.
Precipitator traps china dust, glaze.
Heaters keep air circulation at floor.
Electric heat keeps the varnish thin.

LIGHTING

"What Is Wrong With Our 50-Foot Candle Installations?" by Ward Harrison. *Transactions of the Illuminating Engineering Society,* February, 1937, p. 208. Illuminating Engineering Society, Publishers, 29 West 39th Street, New York City.

The problem of supplying comfortable lighting at the higher levels of illumination.

"Characteristics of the Commercial Lighting Load," by R. R. Herrmann. *Journal of Land & Public Utility Economics,* February, 1937, p. 38. Northwestern University, School of Commerce, Publishers, 337 East Chicago Avenue, Chicago, Ill.

LOAD BUILDING

"'The Best Utility in the World,' say St. Louis Retailers," by B. J. Martin. *Electric Light & Power,* April, 1937, pp. 48-50, 52. Bennett-Watts-Haywood Company, Publishers, 360 North Michigan Ave., Chicago, Ill.

A case study of a well-known utility's sales program.

LOAD FACTOR

"Commercial Load Factor Disclosed by Field Study," by George L. Jorgensen and Ralph L. Matteson. *Electrical World,* April 10, 1937, pp. 56-58, 136. McGraw-Hill Publishing Co., Inc., Publishers, 330 West 42nd Street, New York City.

Survey shows load per customer averages 2.12 kw, load factor 32.4 per cent, diversity factor 1.1 and annual energy use 6,014 kwhr.

METALS

"Working of Nickel-Base Alloys," by F. L. LaQue. *Mechanical Engineering,* March, 1937, p. 175. American Society of Mechanical Engineers, Publishers, 29 West 39th Street, New York City.

Heat-treatment, machining, and welding of Monel, Nickel, Inconel and Hastelloy.

POWER PLANTS

"Monarch Mill Builds New Power Plant." *Power Plant Engineering,* March, 1937, p. 144. Technical Publishing Company, 53 West Jackson Blvd., Chicago, Ill.

Allied Paper Mills adds two 30,000 lb. per hr., and 400-lb. boilers and one 2000-kw. extraction condensing turbine.

STRIP MILLS

"Youngstown Strip Mills." *Iron and Steel Engineer,* February, 1937, p. Y-1. Association of Iron and Steel Engineers, Publishers, 1018 Empire Building, Pittsburgh, Pa.

Description and flow sheet of the continuous hot and cold strip mills at Campbell Works, Youngstown, Ohio.

SWITCHGEAR

"Switchgear Modernized for Plant Reliability," by William A. Foley and Harold C. Paige. *Electrical World,* February 13, 1937, p. 52. McGraw-Hill Publishing Company, Inc., Publishers, 330 West 42nd Street, New York City.

Description of equipment used to promote production efficiency.

WATER HEATING

"Toronto's Experience with Electric Water Heaters for Commercial Customers," by J. F. Thomlinson. *Electrical News and Engineering,* February 15, 1937, p. 28. Hugh C. MacLean Publications, Ltd., Publishers, 347 Adelaide Street West, Toronto 2, Ontario, Canada.

RECENT E.E.I. PUBLICATIONS

RECTIFIER WAVE SHAPE

E.E.I. Pub. E-1. A report of the Electrical Equipment Committee, Edison Electric Institute, 22 pages. Price 40¢ to members and their employees; $1.00 to non-members in tne U.S.A.; $1.10 to foreign countries.

The increasing use of the mercury arc rectifier and various types of electronic devices is a factor in the coordination of power and telephone systems. This report describes the problem and discusses a method of procedure for handling specific situations. Methods of calculation and technical data of use in the solution of particular cases are given.

SPECIFICATIONS FOR THE CONSTRUCTION AND MAINTENANCE OF JOINTLY USED WOOD POLE LINES CARRYING SUPPLY AND COMMUNICATION CIRCUITS

E.E.I. Pub. E-3. A report of the Joint Committee on Plant Coordination of the Edison Electric Institute and the Bell Telephone System, 40 pages. Price 50¢ to members and their employees; $1.50 to non-members in the U.S.A.; $1.60 to foreign countries.

These specifications are based on Part Two, Fourth Edition of the National Electrical Safety Code, with such additions and changes as are necessary to meet new conditions and to take account of increased knowledge of joint use matters. They are recommended for field trial. Where necessary, approval for such trial should be obtained from the proper administrative authorities.

JOINT USE OF POLES—TELEPHONE CIRCUITS AND 6.6 AND 13.2 KV POWER CIRCUITS—SAFETY FEATURES

E.E.I. Pub. E-4 A report of the Joint Subcommittee on Development and Research of the Edison Electric Institute and the Bell Telephone System 18 pages. Price 30¢ to members and their employees; 75¢ to non-members in the U.S.A.; 85¢ to foreign countries.

This report sketches the historical development of joint use and gives the general results to date of the study of the protective problems of lower and higher voltage joint use. The safety features of joint use are reviewed from the standpoint of (1) subscribers' premises, (2) employees, and (3) telephone plant. Characteristics of equipment of power and telephone plant as far as they relate to this problem are given. The various factors which determine magnitude and duration of the current and voltage in the telephone plant resulting from a contact with power conductors are discussed. Methods for obtaining safety for various conditions of joint use are developed. Several specific joint use situations which the Committee has investigated are described and the general features of each case are given. Two illustrative examples are included in an appendix.

CONVENTIONS AND MEETINGS

MAY

2- 3	Hydraulic Power Committee, Edgewater Beach Hotel, Chicago, Ill.
3- 4	Prime Movers Committee, Edgewater Beach Hotel, Chicago, Ill.
3- 4	Electrical Equipment Committee, Edgewater Beach Hotel, Chicago, Ill.
3- 4	Accident Prevention Committee, Edgewater Beach Hotel, Chicago, Ill.
3- 7	American Foundrymen's Association, Milwaukee, Wis.
5- 6	Transmission and Distribution Committee, Edgewater Beach Hotel, Chicago, Ill.
10-12	Institute of Radio Engineers, New York, N. Y.
10-14	National Fire Protection Association, Chicago, Ill.
17	Minnesota Central Station Conference, Hotel Lowry, St. Paul, Minn.
17-19	Heating, Piping and Air Conditioning Association, Minneapolis, Minn.
17-21	National Electrical Manufacturers Association, The Homestead, Hot Springs, Va.
19	South Dakota Central Station Conference, Marvin Hughitt Hotel, Huron, S. D.
20-21	Pacific Coast Electrical Association, annual convention, Hotel Huntington, Pasadena, Calif.
23-27	National Electrical Wholesalers Association, Hot Springs, Va.
24-27	National Association of Purchasing Agents, Pittsburgh, Pa.
27-29	Southeastern Electric Exchange, annual convention, The Homestead, Hot Springs, Va.
28-31	Westinghouse Agent-Jobbers' Association, Hot Springs, Va.

JUNE

1	Westinghouse Agent-Jobbers' Association, Hot Springs, Va.
1- 4	EDISON ELECTRIC INSTITUTE, Palmer House, Chicago, Ill.
20-25	American Home Economics Association, Kansas City, Mo.
21-24	Canadian Electrical Association, Banff, Alberta, Can.
21-24	National Association of Cost Accountants, Hot Springs, Va.
24-26	American Society of Heating and Ventilating Engineers, Swampscott, Mass.

SEPTEMBER

30	Indiana Electric Association, French Lick Springs, Ind.

OCTOBER

1- 2	Indiana Electric Association, French Lick Springs, Ind.

Chicago Is Ready for E.E.I. Convention

(*Continued from page* 158)

the problems which at present are of great concern to the industry.

W. C. Mullendore, executive vice-president, Southern California Edison Company, Ltd., Los Angeles, will follow Mr. Kellogg. Mr. Mullendore is one of the ablest speakers in the electric industry, and his address, "Liberalism and the Electric Industry," should attract attention throughout the country, as it is expected to be a direct answer to some of the industry's most persistent critics.

The final address at this session will be by D. E. Karn, Consumers Power Company, Jackson, Mich., who will speak on "The Status of Rural Electrification." Mr. Karn is chairman of the Rural Electrification Committee of the Institute.

Banquet, Thursday Evening, June 3, 7.30 P.M.

No general sessions are scheduled for Thursday afternoon, which will be devoted to committee meetings or to sightseeing and recreation. Thursday evening the banquet, which will feature Professor Dyer's address, will be held, with President Kellogg presiding. Special entertainment features will precede the address of the evening. Dr. Dyer's barbed wit promises a memorable address.

Final Session, Friday Morning, June 4, from 9.30 A.M. to 12 M.

First scheduled speaker for Friday morning will be R. C. Muir, vice-president in charge of engineering, General Electric Company, Schenectady, N. Y. He has announced his subject as "Some Engineering Contributions to Society," and those who have heard Mr. Muir can prophesy an address which will be completely absorbing to his listeners. Following this will be Dean Madden's address, "The Electric Industry Re-examined," which alone should be worth the trip to Chicago for any utility man.

The remainder of this session will be devoted to the presentation of the Coffin Award, by President Kellogg, and of the other prize awards including The Bylles-by, Lindemann, Forbes, McGraw, George A. Hughes, Augustus D. Curtis and Thomas W. Martin, by Frank W. Smith, Chairman of the Prize Awards Committee, and to the introduction and installation of officers as the closing event of the Institute's fifth Convention.